Ontario

2004 Annual Report

Lake Erie Management Unit

The Lake Erie Management Unit of the Ontario Ministry of Natural Resources is responsible for managing the fishery resources of the Ontario waters of Lake Erie, as well as the upper Niagara River, the Detroit River, Lake St. Clair, and the St. Clair River.

Ontario has been responsible for managing the fishery resources of these waters since 1898. In 1992, the Lake Erie Management Unit was created to improve Ontario's ability to manage these important resources. The Unit is based in London with field offices in Port Dover and Wheatley.

VISION: The Lake Erie Management Unit will contribute to the environmental, social, and economic well-being of the people of Ontario through the sustainable development of fishery resources within the Lake Erie basin.

MISSION: To ensure the long-term health of the Lake Erie ecosystem and to promote the sustainable harvest and development of its fishery resource through sound science, assessment, regulation, and advocacy.

GOAL: To foster and encourage the understanding of all users and partners on the complexity of managing the fishery resource of Lake Erie, to minimize conflict, and to endorse sound fishery management practices.

Lake Erie's fishery resources are managed cooperatively by Ontario and the four U.S. states – New York, Pennsylvania, Ohio and Michigan - bordering the lake through a process set out by the Great Lakes Fishery Commission and the Joint Strategic Plan for Management of Great Lakes Fisheries. Lake St. Clair's fishery resources are managed cooperatively by Ontario and Michigan under the same process.

Cover Photos: (top to bottom) –

- Assessment of Lake Erie whitefish stocks funded by Canada-Ontario Agreement (COA);
- Assessment of fish species at risk in the St. Clair River by Department of Fisheries and Oceans and MNR and funded by COA ;
- Ontario Commercial Fisheries Association conducts the annual Partnership Index survey on Lake Erie;
- MNR's annual fall trap net index survey on Lake St. Clair

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Lake Erie Management Unit

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Table of Contents

2004 Status of Major Stocks 3

2004 Project Updates
- Sport Fishing Regulations 5
- Lake Erie Program Committee 6
- Enforcement Update 7
- East Basin Rehabilitation Plan 8
- Southern Grand River Assessment 2002-2004 8
- Contaminant Monitoring 11
- Stocking Summary 14

LEC Activities
- Coordinated Percid Management Strategy 14
- Decision Analysis 15
- Environmental Objectives 17
- International Mediation of 2004 Lake Erie Walleye Total Allowable Catch 18
- St. Clair System Fish Community Goal and Objectives 19
- Walleye Management Plan 29

2004 Outreach Updates
- Angler Outreach 35
- Commercial Outreach 37
- Other Outreach 38

2004 LEMU Staff 39

2004 Project Reports 40
- Lake Erie Basin Annual Report 2004/2005 (Canada-Ontario Agreement)
- Winter Access Point Creel Survey 2004: Inner Long Point Bay, Lake Erie
- Ontario Walleye Scale/Otolith Aging Comparison
- 2004 Lake Whitefish Survey Summary
- Lake Erie Central Basin Access Creel Survey, 2004

2004 Status of Major Stocks

The following is an overview of the status of major species in Ontario waters of Lake Erie for 2004. Lake-wide perspectives are available in the following reports of the Lake Erie Committee (LEC) of the Great Lakes Fishery Commission:

- Walleye Task Group Report
- Yellow Perch Task Group Report
- Forage Task Group Report
- Cold Water Task Group Report
- Habitat Task Group Report

A more detailed account of the results of the 2004 Lake Erie Management Unit (LEMU) core program fisheries assessment activities can be found in LEMU 2004 Status of Major Stocks[1].

Walleye

In 2004, commercial catch rates for walleye increased from those observed in 2003. This was the fourth consecutive year of increasing catch rates. These increases are a result of high survival rates and the strong 1999, 2001, and 2003 year classes supporting the fishery. In contrast the 2002-year class appeared to be one of the weakest as young-of-the-year. In 2003, the young-of-the-year (YOY) index in the west basin yielded the largest showing of young walleye for the recent time series. Due to the weak 2002 year class, the number of age 2 recruits in 2004 was low, however the 2003 year class contributed to the 2004 fishery and will continue to contribute strongly to the fisheries of 2005 and 2006. This is fortunate, as interagency YOY trawling in August of 2004 revealed below average catch rates and expectations for the magnitude of the 2004 year class as it recruits to the fishery in 2006 are low.

In response to negative indicators including spatial differences in fishery performance, the Coordinated Percid Management Strategy (CPMS) was developed by the Lake Erie Committee (LEC) of the Great Lakes Fishery Commission (GLFC). In 2001, a three-year conservative allocation, coupled with reduced spring angling bag limits, was started in order to promote the rebuilding of Lake Erie walleye stocks. Through LEC efforts, additional emphasis was placed on mixed stock genetic analyses, tagging analyses and factors that influence the spatial distribution of walleye. Work on these projects is on-going, and some results are expected in 2005. Other initiatives such as the Walleye Management Decision Analysis model (completed in late winter 2005) have helped to enhance our understanding of population dynamics and management of walleye in Lake Erie.

In 2005, the LEC and the Lake Erie Management Unit are finalizing a Walleye Management Plan (WMP) for Lake Erie. Within this plan framework, there is an exploitation policy scheduled for implementation in March 2005. In conjunction with decision analysis techniques and population model refinements, the results of this work will help to understand the risks associated with various management options and help to optimize quality and ensure the sustainability of the sport and commercial fisheries well into the future.

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[1] Lake Erie Management Unit. 2005. 2004 Status of Major Stocks. Technical Report. 62 pp.

Walleye in eastern Lake Erie consists of mixed stocks including those originating from east basin shoals, the Grand River, and immigrants from the rest of the lake. Representation of walleye ages 4 and older was greater in eastern Lake Erie compared to other regions of the lake, based on the age composition of the commercial harvest and the partnership gill net index. The greater average age of walleye in the eastern basin is due in part to the contribution of older migratory individuals originating from the western basin. A 5-year plan to rehabilitate east basin walleye and yellow perch stocks began in 2000. Under the plan, conservative allocations, along with seasonal commercial and angling sanctuaries, are expected to enhance local walleye and yellow perch populations. In 2004, this program ended, with results from a variety of basin specific research and assessment programs documented, and fisheries management recommendations combined in a technical report (see East Basin Rehabilitation Plan section on page 8). Management options for East Basin percid fisheries will be implemented by April 2005.

Yellow Perch

Yellow perch populations in Lake Erie have undergone large-scale fluctuations in recruitment and survival over the last several decades. High harvest levels during the 1980's could not be sustained through the early 1990's due to low recruitment and low survival rates. Increased recruitment during the mid-1990's peaked with the exceptionally strong 1996-year class. In 2001 the yellow perch hatch was considered above average, it contributed significantly to the commercial fishery in 2003 and in 2004. In 2002, yellow perch YOY abundance was observed to be one of the lowest on record. This had implications for the fishery in 2004 as yellow perch populations declined below their recent peak in abundance. However, similar to the strong year class seen for walleye, the 2003 YOY trawl index for yellow perch was one of the highest on record. Given the contributions of the next strongest hatch on record (1996) to the fish population, it is expected that this (2003) year class will continue to support a large and healthy yellow perch fishery in the years to come. This year class will begin to recruit to the various sport and commercial fisheries in 2005, and make a major contribution lake-wide by 2006.

Rainbow Smelt

The lake-wide smelt harvest of 13 million pounds represented 81% of the assigned quota in 2004. This increased harvest over previous years was in part due to increased market demand, and was driven by the very strong 2003 year class entering the fishery. Year class strength continues to oscillate from year to year, possibly driven by the cannibalistic behaviour of yearling smelt and poor survival beyond age 2, the age at which most smelt are mature. The strong 2003 year class contrasts starkly with the recent recruitment of rainbow smelt which has remained below levels of the 1980's and early 1990's, as indicated by Outer Long Point Bay index trawling and commercial fishery trends. The Outer Long Point Bay index trawling indicated that the 2004 year class of smelt is weak. In contrast, the 2003 indices of YOY smelt abundance were the largest for the time series, with this year class set to support the bulk of the smelt fishery for the next 2 years. These fish will undoubtedly contribute greatly to the diets of walleye and yellow perch throughout the lake.

Lake Whitefish
Ontario's lake whitefish harvest of 617,000 pounds in 2004 was similar to the amount harvested in 2003. The harvest of lake whitefish was divided between basins, with 48% of the harvest in quota area 1 and 44% of the harvest in quota area 2. The age composition of the harvest was broad, represented by ages 3 to 12, with the majority of fish ages 5 to 8 and a mean age of 6.5 in the west basin. A large decline in catch-per-unit-effort (CPUE) in 2002 and 2003 (up slightly in 2003 over 2002) with respect to 2001 was observed, with weather related effects on the fishery and poor recruitment through the late 1990s being possible causal factors. CPUEs in 2004 were similar to those in 2003 in quota zones 2 and 3. In quota zone 1 the 2004 CPUE increased over the 2003 CPUE. This increase occurred during the fall fishery in the month of October, however CPUEs declined slightly in November and December from 2003 values.

While fishery trends help to describe the status of whitefish stocks, estimating recruitment of younger fish remains a challenge. Due to migratory and schooling behavior of this species, whitefish assessment in Lake Erie is complex and problematic. During the last two years, whitefish catches have been negligible in the east basin index, though central basin catches ranged from moderate to above average. The 2001 and 2003 year classes however, appear promising to the fishery in the future. While observed in moderate numbers in the 2000 partnership index program, until 2001 there was little evidence of the 1997-year class of whitefish in Lake Erie. However, this year class contributed significantly to the 2003 and 2004 fisheries. The 2001 year class, which was observed to be strong as YOY, was encountered as age 3 in the 2004 commercial fishery but was not prominent in the partnership index gear. It is hoped that this year class will recruit to the fishery in 2005. In order to increase our knowledge of whitefish stocks using a fishery independent method, whitefish spawning surveys were carried out in the autumn of 2002 and 2004. However, these surveys proved inefficient at capturing sufficient numbers of whitefish to be used as a management tool.

2004 Project Updates

Sport Fishing Regulations
In 2004 a closed season for walleye angling took effect from March 15 to the Friday before the second Saturday in May (May 7, 2004) in the central and western basins of Lake Erie. The rationale for this regulation change was to protect staging and spawning walleye to promote successful reproduction. The change also served to standardize the spring closed season throughout Division 2. The closed spring season had been in place in the eastern basin of Lake Erie since 2000.

Also in 2004, the yellow perch daily catch and possession limit in the eastern basin of Lake Erie increased to 50 yellow perch for the sport licence (25 for the conservation licence). Yellow perch abundance had increased dramatically in recent years, and as a result, restrictions on harvest by both the recreational and commercial fisheries were reduced. The changes also served to standardize the daily catch and possession limit for yellow perch in Divisions 1 (St. Clair System) and 2 (Lake Erie).

OMNR Streamlining of Sport Fishing Regulations

The OMNR is redefining provincial sport fishing division boundaries to reduce the number of divisions (currently 37 provincially), base boundaries on ecological and social factors (e.g., climate zones, watersheds, fishing pressure, road networks), and clearly define the boundaries for anglers and conservation officers. Scheduled to take effect in 2007, 20 Fisheries Management Zones will replace the divisions. Each management zone will have simpler, more consistent regulations that are more easily understood. Lake Erie and Lake St. Clair will be combined into the one management zone that also will encompass the Niagara River, the Detroit River and the St. Clair River. Lake Erie Management Unit staff have been integral in defining boundaries for the new management zones.

Streamlined fishing regulations are also scheduled to be in place for 2007. The regulations are being prepared using the best available scientific data and information. Each tool kit will provide guidelines for managing sport fisheries with, where possible, standardized regulations that are easy to understand and support. It is expected that there will be a total 18 tool kits developed for sport fish species. The Muskellunge Tool Kit and the Splake Tool Kit were the first prepared. The management direction provided in the Muskellunge Tool Kit helped to inform proposed length limit regulation change presented by the LEMU to stakeholders in 2004. Yellow Perch, Brown Trout and Crappie Tool Kits were prepared by OMNR in 2004 and LEMU staff provided comments on the contents of these Tool Kits. All future changes to sport fishing regulations will need to be rationalized with the information provided in an OMNR Tool Kit.

Lake Erie Program Committee

The Lake Erie Program Committee (LEPC) was initiated in 1992 as a means for Lake Erie fishery resource user groups to interact with the Ontario Ministry of Natural Resources' LEMU on issues related to the management of the resource. The LEPC provides a forum for increased communication and transparency between the LEMU and its client groups.

Membership in 2004 consisted of the following:

Ontario Commercial Fisheries Association
Peter Meisenheimer – Executive Director
Ron Harvey – Operations Manager
Kevin Reid – Fisheries Biologist
Larry Jackson - President

Ontario Federation of Anglers and Hunters
Russ Piper – Past President and Chairman of Provincial Fish Committee
Felix Barbetti – Zone J and Dunnville Hunters and Anglers Club
Alf Marinelli – Zone J and Port Colborne and District Conservation Club
Dave Brown – Fisheries Biologist

Bait Association of Ontario
Harold Harvey – Executive Director

Meetings held March 18, October 25 and December 7. Meeting topics included:
Status of stocks – yellow perch, walleye, whitefish, smelt; Lake Erie Committee mediation report; Thames River fishery management plan; charter boat survey; Lake St. Clair fish community goals and objectives, angler outreach, 6% initial walleye allocation; cormorants; East Basin management plan; Lake Erie Committee walleye objectives; Lake Erie Committee yellow perch objectives; decision analysis; Thames River Springbank dam; increasing transparency of Lake Erie Committee decisions.

Enforcement Update

The LEMU enforcement program operated with two fulltime Conservation Officers short in 2004, one officer was off for six months from mid-March to September on short term sickness and the other was on an acting assignment from August to the end of the year after which he accepted a lateral transfer out of the unit. Contract Conservation Officer appointments totalling seven months of effort helped ease the manpower shortage but this was largely a training period for the two officers involved, who were successful in obtaining full time Conservation officer positions outside LEMU. In addition, the Lake Erie Enforcement Supervisor accepted an assignment outside the unit and the enforcement program was under the direction of an acting supervisor.

Officers contacted a total of 7,110 residents and 776 non-residents; issued 412 warnings and laid 381 charges. The compliance rate for the unit was 85.52% which is somewhat below the Provincial standard. The compliance rate for commercial fish was 91.5% and 86.95% for sport fish. Commercial fish charges accounted for 25.7% of the charges and sport fish 67.4%. The remaining 6.9% of the charges occurred while assisting other districts with big and small game enforcement checks. A total of $19,535.00 was collected in fines for commercial fish convictions and $45,118.00 for sport fish convictions.

In addition to the above charges, a major investigation concerning the illegal commercialization of fish resulted in a further 349 charges being laid for various offences under the Ontario Fishery Regulations and the Fish and Wildlife Conservation Act for the unlawful purchase and sale of non-commercial fish. In excess of $101,000.00 in fines have been levied to date as a result of this major investigation. There are a total of 15 charges for the unlawful take, sale and transport of fish remaining to be heard by the courts.

The Port Officer program continued to operate effectively with officers doing commercial fish weight verification and vessel inspections at dockside and in the plants. The Port Officer program also operated shorthanded throughout much of the season due to Acting Conservation Officer assignments and a transfer out of the Unit as a Conservation Officer. One Port Officer at Wheatley covered off Wheatley, Kingsville, Erieau and Port Stanley Ports with success as the overall weight variation between fisher declared weight and observed weights met acceptable standards. Much of this success is attributed to the cooperative efforts and assistance of the weight verification clerks employed by the Ontario Commercial Fisheries' Association that observe weights in the plants.

East Basin Rehabilitation Plan

From 2000 to 2004, the eastern basin was managed independently under a rehabilitation initiative, with the active collaboration and support of commercial and sport fishermen. The fish populations were monitored during this period and additional work was undertaken to try to understand the management issues in this area of the lake.

The successful completion of the rehabilitation plan was to occur in four steps:

1. The development of a technical report to provide background information about the current status of the fisheries and habitats and to support dialogue with users regarding how to manage the fisheries.
2. The development of a set of management alternatives by the East Basin Technical Committee (scheduled for January 2005).
   The East Basin Technical Committee membership included LEMU staff, representatives of the Ontario Commercial Fisheries' Association, representatives of the Ontario Federation of Anglers and Hunters, and members of the commercial fishing industry.
3. The presentation of the management alternatives in public consultation sessions (scheduled for February 2005).
4. The development of a management strategy for the eastern basin (scheduled for March 2005).

The draft technical report (Status of the Fish Community and Fisheries in Eastern Lake Erie 2004) was produced to summarize the state of current knowledge about the fish populations and fisheries of the eastern basin and provide information on which to make management decisions for 2005. The contents of this draft report include:

- Ecology of eastern Lake Erie
- Performance of fisheries and changes in regulations
- Economic value of fisheries
- Status of stocks (walleye, yellow perch, smallmouth bass, lake whitefish, rainbow smelt)

Southern Grand River Assessment (2002-2004)

Work begun in 2000, as part of the LEMU's 5 year eastern basin restoration plan to assess habitat quality and its use by walleye and yellow perch, became focussed on the lower reaches of the Grand River during the period of 2002-2004. Building on partnerships established with local conservation clubs (Dunnville District Hunters and Anglers, Port Colborne Conservation Club, Fort Erie Conservation Club; the tri-clubs) and the Grand River Conservation Authority (GRCA), and with funding from the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA) detailed information was collected on Grand River walleye stock migrations, demographics, and potential restrictions to production including access to spawning substrate, water quality, and temperature/oxygen limitations.

Walleye Migrations

Electrofishing has been used by the LEMU to assess walleye within the Grand River since 1999. Spring, summer and fall fishing in 2002-2004 further highlighted the fact that, while walleye utilize the Grand River throughout the year, the demographics of the catch change seasonally to reflect the aggregation of larger/older fish which move out of the river in the late spring and return in the early to late fall. Resident walleye, which remain in the river throughout the summer, are predominantly younger fish.

Walleye moving into the Grand River from the lake have free access to the first 7km of river, from Port Maitland to Dunnville, beyond which access is limited by a low-head dam. Previous surveys have established that most of the potential walleye spawning habitat in the lower river exists upstream of the Dunnville dam; between Cayuga and Caledonia. Walleye from spawning run aggregations were captured, marked with jaw and dorsal tags, and released both above and below the dam. During the springs of 2002, 2003 and 2004, the total numbers of walleye transported over the dam were 107, 154, and 516; respectively. The capture of walleye each spring has been done in conjunction with the tri-club hatchery collection and it should be noted that the spring 2002 tag and release program was completely dependent on the work of the clubs and the GRCA; MNR staff were not available due to ongoing public service contract negotiations. Recapture information from both MNR ongoing assessment and angler reporting has provided strong support to assumptions regarding upstream/downstream movement, summer habitat use, and stock fidelity to spawning grounds.

Monitoring of a fishway at Dunnville (Byng Conservation Area), constructed in 1995 by the GRCA and designed to pass non-jumping fish such as walleye, provided additional information about the timing of the spawning run and the ability of walleye to access upstream habitat unassisted. Much of the monitoring work is accomplished by volunteer groups which include the tri-clubs and the Dofasco Angling Club; the LEMU along with the GRCA supplemented this monitoring in 2002-2004 allowing for a broader sampling program. Catch per unit effort for walleye captured in the monitoring cage was 0.172, 0.507, and 0.114 walleye/hour, respectively, over the period of 2002-2004 (mean 1995-2001: 0.061 walleye/hour). While success rate for passage of walleye by the fishway seems to have improved in recent years, best estimates of total number passed are still smaller than estimates of the total spawning run (4500 walleye; 2001 estimate) by a factor of ten.

Further to the mark-recapture and fishway cage-monitoring, radio telemetry was incorporated into the spring walleye program in 2003. Thirty walleye, captured from the spring spawning aggregation, were internally implanted with radio-transmitters and released, half above the Dunnville Dam and half below. Weekly tracking was conducted by boat and truck over the 42 river kilometres from Port Maitland to Caledonia (the first barrier above Dunnville). In addition to mobile tracking, a 24-hour/day logging station was established at the Dunnville fishway in order to monitor fishway passage success. The radio tags were designed to transmit until November 2003. In the spring of 2004, 15 additional walleye were implanted with radio tags designed to transmit into the fall of 2005.

To date, the walleye telemetry work has yielded valuable data relating to movement in and out of the river and substrate choice during spawning conditions. Fish which were able to be tracked over extended periods displayed rapid upstream movement to areas of gravel/hard substrate, residency in these areas for several days to weeks, followed by gradual downstream movement prior to summer. Areas where fish lingered, both above and below the Dunnville dam, correspond well with areas previously identified as good walleye spawning habitat.

None of the 14 radio-tagged walleye tracked below the dam were able to negotiate the Dunnville fishway although 35% did make attempts and were able to navigate at least 1/3 of the way into the structure. Results were comparable to a previous telemetry study conducted at the fishway in 1997. In addition to re-confirming the results of the fishway cage monitoring; that only a small proportion of the spawning run successfully use the fishway, the results also suggest that more effective cage monitoring would have to take place during night-time hours. Most of the radio telemetry fishway attempts occurred between 17:00 and 6:00.

Concurrent with sampling of the walleye spawning run, temperature and flow data was collected in order to correlate run timing with environmental cues.

Water Quality and Environmental Conditions
Previous analysis of the overall fish community structure within the lower Grand River suggested that poor water quality conditions existed prompting an assessment of nutrient and suspended solid concentrations, algal production, benthic invertebrate community and temperature/oxygen conditions from 2002-2004. Preliminary work in 2002 showed the potential for the exclusion of some fish from deep cool water refuges due to low oxygen conditions; especially during times of low flow. During 2003 and 2004, water samples collected at intervals from Brantford, downstream to Port Maitland, and analysed for total phosphorus, nitrogen compounds, suspended solids, chlorophyll-a. Results confirmed what was suggested by the fish community indexes; the water quality within the lower Grand River was found to be degraded. During the summer it was typically high in nutrients, and suspended solids; levels of total phosphorus and nitrates frequently exceeded provincial/federal water quality objectives. Corresponding high suspended algal production combined with high suspended solid loads result in conditions where submerged macrophytes are scarce. Chlorophyll-a concentrations are indicative of hyper-eutrophic trophic status and are high enough that they seem to be able to drive diurnal oxygen cycles despite the scarcity of macrophytes. Temperature and oxygen depth profiles indicated that the potential exists, particularly under low flow conditions, for some fish species to be excluded from much of the lower river habitat. Benthic invertebrate surveys similarly pointed to eutrophic and compromised habitat.

While a large proportion of the spring spawning run moves out of the lower river in late spring, some, primarily younger fish, remain in the lower river throughout the summer. In June 2003, 30 walleye were captured above the Dunnville dam and implanted with radio transmitters in order to monitor the summer movement of "resident" walleye especially in relation to gradients in temperature and oxygen conditions. These fish were found to stay within a very restricted home range throughout the course of the summer.

Walleye Recruitment

Fall electrofish surveys targeting young-of-the-year (YOY) walleye have been conducted in the lower Grand River by the LEMU since 1999. While none were found in 1999, several were detected in 2000. Catch per unit effort increased tenfold between 2000 and 2001 and remained similar and high from 2002 through 2004 (10.3, 7.8, 10.3 walleye/hour; respectively). These higher CUEs in recent years correspond with the initiation of the spring program of manually lifting walleye over the dam at Dunnville although no direct relationship is apparent between number of spring spawners moved and number of fall YOY. This work will be used to develop a standardized index of recruitment for the Grand River stock of walleye.

Southern Grand Assessment Synopsis

Several of the Southern Grand River sampling programs, including spring assessment, radio tracking and young-of-the-year surveys, will continue through 2005. Final reporting on all the state of the southern Grand River is anticipated for spring 2006.

Contaminant Monitoring

Each year samples of western basin walleye, central basin rainbow smelt and eastern basin lake trout are collected are sent to Fisheries and Oceans, Canada (DFO) for contaminant analyses. Results of the analyses are reported in the Great Lakes Contaminants Surveillance Program (Table 1). Whole body burdens of polychlorinated biphenyl's (PCBs), organochlorine pesticides and trace metals such as mercury are measured. Lake Erie consistently has the lowest level of contamination of all of the Great Lakes monitored by DFO.

Table 1. Species, number of fish required and collected, and area of capture for fish sampled in 2004 by LEMU for analysis by the Department of Fisheries and Oceans, Canada as part of the Great Lakes Contaminants Surveillance Program.

Species	# Required	# Captured	Area Capture
Walleye	50	50	West Basin Lake Erie
Lake Trout	25	25	East Basin Lake Erie
Smelt	100	100	West-Central Lake Erie
Alewife	20	2	Lake Erie
Freshwater Drum	5	5	Lake Erie
Total	**200**	**182**	

Fillets from various Lake Erie fish species are also collected each year for the Ontario Ministry of Environment as part of their Sport Fish Monitoring Program (Tables 2 and 3). The results of these analyses, along with trends and guidelines for consumption, are reported biannually in the publication *Guide to Eating Ontario Sport Fish*.

Table 2. Species, number of fish required, number of fish captured, and area of sampling for fish collected in Lake Erie in 2004 by the Lake Erie Management Unit for analysis by the Ministry of Environment as part of the Sport Fish Monitoring Program.

Species	# Required	# Captured	Area of Capture
Walleye	20	20	West Basin Lake Erie
White Bass	20	20	West Basin Lake Erie
Whitefish	20	20	West Basin Lake Erie
Channel Catfish	20	10	West Basin Lake Erie
Total	**80**	**70**	
Walleye	20	20	Central Basin Lake Erie
White Bass	20	20	Central Basin Lake Erie
Rainbow Trout	20	5	Central Basin Lake Erie
Whitefish	20	7	Central Basin Lake Erie
Channel Catfish	20	15	Central Basin Lake Erie
Total	**100**	**67**	
Yellow Perch	20	4	Rondeau Bay
Bluegill	20	13	Rondeau Bay
Northern Pike	20	1	Rondeau Bay
Largemouth Bass	20	2	Rondeau Bay
Carp	20	7	Rondeau Bay
Black Crappie	20	6	Rondeau Bay
White Bass	20	0	Rondeau Bay
Total	**140**	**33**	

Table 3. Species, number of fish required, number of fish captured, and area of sampling for fish collected in Lake St. Clair, the Detroit River and the Thames River in 2004 by the Lake Erie Management Unit for analysis by the Ministry of Environment as part of the Sport Fish Monitoring Program.

Species	# Required	# Captured	Area of Capture
Walleye	20	16	Detroit R. Upper River
White Bass	20	20	Detroit R. Upper River
Yellow Perch	20	20	Detroit R. Upper River
Carp	20	20	Detroit R. Upper River
Total	**80**	**76**	
Walleye	20	3	Detroit R. Lower River
White Bass	20	15	Detroit R. Lower River
Yellow Perch	20	20	Detroit R. Lower River
Channel Catfish	20	0	Detroit R. Lower River
Freshwater Drum	20	9	Detroit R. Lower River
Carp	20	0	Detroit R. Lower River
Total	**120**	**47**	
Walleye	20	20	Lake St.Clair
Northern Pike	20	19	Lake St.Clair
White Bass	20	20	Lake St.Clair
Smallmouth Bass	20	20	Lake St.Clair
Largemouth Bass	20	20	Lake St.Clair
Pumpkinseed	20	20	Lake St.Clair
Rock Bass	20	20	Lake St.Clair
Bluegill	20	2	Lake St.Clair
Total	**160**	**141**	
White Perch	20	20	Thames River (mouth)
Channel Catfish	20	20	Thames River (mouth)
Freshwater Drum	20	11	Thames River (mouth)
White Sucker	20	20	Thames River (mouth)
Carp	20	20	Thames River (mouth)
Rainbow Trout	1	1	Thames River (mouth)
Pumpkinseed	2	2	Thames River (mouth)
Smallmouth Bass	1	1	Thames River (mouth)
Bluegill	4	4	Thames River (mouth)
White Bass	20	20	Thames River (mouth)
Black Crappie	7	7	Thames River (mouth)
Northern Pike	8	8	Thames River (mouth)
White Crappie	17	17	Thames River (mouth)
Walleye	19	19	Thames River (mouth)
Total	**179**	**170**	

Stocking Summary
The MNR Normandale Fish Culture Station transferred 65,000 rainbow trout fingerlings to the Lake Erie Salmon and Trout Club in Port Stanley in fall 2003. A total of 34,600 of these fish were stocked as yearlings by club members into Mill Creek, a tributary of Kettle Creek, between May 24 and 26, 2004. The rainbow trout were Ganaraska River strain and all had left pectoral clips.

Salmonid stocking information for 2004 from all jurisdictions around Lake Erie can be found in the 2004 Lake Erie Coldwater Task Group Report.

2004 LEC Activities

On Lake Erie, fisheries resources are managed cooperatively by the States of Michigan, Ohio, Pennsylvania, and New York in concert with the Province of Ontario. Together, these jurisdictions make up the Lake Erie Committee (LEC).

Coordinated Percid Management Strategy
The LEC completed the report documenting the Coordinated Percid Management Strategy (CPMS)[2]. Below is the executive summary from the report (the report can be found on the Great Lakes Fishery Commission website www.glfc.org).

Lake Erie walleye and yellow perch populations peaked in the late 1980s, but had declined to low levels of abundance by the late 1990s. As a result, the Lake Erie Committee decided to initiate the Coordinated Percid Management Strategy (CPMS), a 3-year (2001-2003) lake-wide management approach developed to halt population decline, ensure sustainable harvest, and promote stock recovery for walleye and yellow perch. The objectives of the strategy were to reverse declines and rebuild percid stocks to achieve broad distribution of benefits throughout the lake, and to improve approaches used to estimate percid abundance and determine sustainable harvest levels.

To achieve the first objective, the LEC reduced walleye harvest by altering recreational fishing regulations and reducing quota to the commercial fishery (Ontario). Population abundance of walleye increased during 2001-2003 as a result of harvest reductions and a strong 1999 year class. Although the decline in walleye abundance was halted, fisheries were not restored lake-wide to desired levels and the rebuilding effort was not completed in 2003.

Yellow perch abundance was increasing at the onset of the CPMS, thus the LEC continued to set conservative TAC's but did not reduce harvest between 2001 and 2003. Indeed, TAC increased during those years, reflecting the increased abundance of yellow perch.

To achieve the second objective, the previous virtual population model was replaced with a revised catch-at-age analysis that incorporated independent stock assessment data and longer time series of fishery data than previously used. Revised models for walleye and yellow perch were peer-reviewed by independent, non-government scientists. The reviewers largely supported the revisions and recommended some additional changes, several of which were subsequently put into practice.

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[2] Lake Erie Committee. Lake Erie Coordinated Percid Management Strategy. December 2004. Pp 33.

The LEC realized that while exploitation could be curtailed to promote percid populations, a healthy Lake Erie environment would be necessary for long-term sustainability of fisheries. Therefore, a number of habitat restoration projects were initiated during the CPMS and much work was completed on drafting Environmental Objectives that could be used to influence future habitat projects.

Decision Analysis

Decision Analysis (DA) is a tool that helps to break complex decisions into manageable components by taking into consideration objectives, options, uncertainties, and risk assessment. Decision analysis is unique because of the explicit inclusion of uncertainties, however a key component of the process is the formal recognition of objectives.

The Lake Erie Committee began working with DA in 2001 to help incorporate uncertainty into decisions on total allowable catch of walleye. Fisheries objectives were documented and a stochastic forecasting model was developed by fishery modeling experts at Michigan State University. The model was still in draft form at the end of 2004. Staff from the LEMU were integral in the development of the DA model. The majority of model development activities took place between November 2003 and December 2004.

The LEC agencies developed harvest and abundance objectives for their respective walleye fisheries that were combined into population categories in 2004[3] as follows:

<15 M walleye	- population in crisis
15-20 M	- population in rehabilitation
20-25 M	- population provides low quality fisheries
25-40 M	- population in maintenance and provides fisheries that meet the objectives stated by LEC member agencies
> 40 M	- population provides high quality fisheries.

An explicit management objective (to maintain the abundance of walleye at a specific level, preferably in the maintenance or high quality fisheries levels) was used to guide the DA model.

The use of DA in fisheries management is relatively recent. It is intended to help managers make better informed decisions and as well as to help managers to share the rationale for their decisions with stakeholders. During the development of objectives and the model, the DA process was discussed with stakeholders.

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[3] The population abundances shown here refer to ADMB runs using data up to, and including, 2003.

The LEMU developed several objectives intended to guide decisions:

- To provide a healthy, balanced fish community with a diverse assemblage of self-sustaining native species/stocks with walleye as the top predator

The community that is healthy and balanced is best achieved by maintaining a sufficient abundance of walleye and other top predators to help structure the community (i.e., minimize the abundance and influence of alewife, smelt and shad, favouring percids and coregonids). Healthy fisheries are composed of a wide range of age classes with relatively high biomass levels and thus produce high catch-per-unit-effort (CPUE) and high total catches from low fishing effort (Allen, 2003[4]).

- To manage walleye fisheries for sustainable development that contributes to economic benefit for Ontario

MNR's vision is for sustainable development of natural resources. The decision-making process regarding resource management must then take into consideration the integration of social needs, economic objectives, and environmental considerations. MNR's mission is ecological sustainability with several desired outcomes, including maintaining the long-term health of ecosystems, the continued availability and sustainability of natural resources, and the maintenance of economic development potential associated with natural resources. Increasing the profile of the recreational fishery should, in turn, promote angler licence sales, bait sales, and the charter industry. Therefore, it will be necessary to maintain populations and stocks at favourable abundance levels for both the commercial and recreational fisheries, as defined using biological reference points.

- Harvest walleye in a socially and environmentally responsible manner

Encourage management practices that minimize the reliance on juveniles in the harvest and protect spawning fish. Encourage consistent management practices that set reasonable allocations (based on sustainable, and economically viable exploitation policies) derived from the best population models available. Encourage stewardship with the commercial industry so that commercial fishers better adhere to the Code of Conduct for Responsible Fishing Operations (revised to meet the needs of the inland fishery). The commercial industry will be encouraged to think progressively to minimize the losses of commercial markets, to minimize the harvest of immature fish, reduce incidental catch, minimize discard of incidental catch, minimize interference with spawning activity, and increase the marketing and use of underutilized or incidentally harvested species. The commercial and sport fisheries will be regulated as necessary to sustain fisheries and both fisheries will be encouraged to handle fish responsibly, minimize discard, and find value in underutilized or alternative species.

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[4] Allen, R.B. 2003. Understanding the Area 2 lobster fishery collapse and doing something about it: The biological and economic basis for rebuilding the Southern New England lobster fishery. Third Edition. R.B. Allen Associates. Pp 106. http://www.lobsterconservation.com/nss-folder/fisherycollapsebooklet/.

- To promote the objectives from Lake Erie initiatives that relate to walleye

  Recognize and support objectives developed for other initiatives, particularly those initiatives that LEMU has participated in developing, i.e., Fish Community Goal and Objectives, Environmental Objectives, Coordinated Percid Management Strategy, etc. Recognize and support the objectives developed for management plans, particularly those initiatives that LEMU has participated in developing, i.e., Lakewide Management Plan, Lake St. Clair-St. Clair River Management Plan, etc. Recognize and support policies such as No Net Loss, etc. Work to develop, as needed, policies with goals of conservation, restoration or protection of aquatic production (e.g., for lake effect zones, wetlands, shorelands, nearshore habitats, offshore habitats).

The LEMU also manages the fisheries of Lake Erie using the input of stakeholders. The objectives of stakeholders are outlined in the Stakeholder Objectives Report contained in this LEMU Annual Report.

Environmental Objectives

The LEC's Habitat Task Group initiative to develop Environmental Objectives (EOs) for Lake Erie has been ongoing for several years but neared completion in 2004. Several LEMU staff are members of the Habitat Task Group and participated in the development of the EOs.

The EOs were developed to assist the achievement of the Lake Erie Fish Community Goals and Objectives[5] by identifying and defining critical environmental conditions. It was intended that management agencies use the EOs as guidelines to manage fisheries resources, establish conditions needed to ensure that the Fish Community Goals and Objectives will be achieved, and to set restoration priorities and activities.

The Lake Erie Fish Community Goals are:

- To secure a balanced, predominantly cool-water fish community, with walleye as a key predator in the western basin, central basin, and the near-shore waters of the eastern basin, characterized by self-sustaining indigenous and naturalized species that occupy diverse habitats, provide valuable fisheries, and reflect a healthy ecosystem.
- To secure a predominately cold-water fish community in the deep, offshore waters of the eastern basin with lake trout and burbot as key predators.

The draft Environmental Objectives are:

Water Levels and Climate Change

- Recognize and anticipate natural water level changes and long-term effects of global climate change and incorporate into management decisions

Coastal and Shoreline Processes

- Restore natural coastal systems and nearshore hydrological processes

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[5] Ryan, P.A., Knight, R., MacGregor, R., Towns, G., Hoopes, R., Culligan, W. 2003. Fish-Community Goals and Objectives for Lake Erie. Great Lakes Fish. Comm. Spec. Publ. 03-02. 56 p.

Rivers and Estuaries

- Restore natural hydrological functions in Lake Erie rivers and estuaries

Open Water Transparency

- Re-establish open water transparency consistent with mesotrophic conditions that are favourable to walleye in the central basin and areas of the eastern basin

Dissolved Oxygen

- Maintain dissolved oxygen conditions necessary to complete all life history stages of fishes and aquatic invertebrates

Wetlands and Submerged Macrophytes

- Restore submerged macrophyte communities in estuaries and embayments and protected nearshore areas

Contaminants

- Minimize the presence of contaminants in the aquatic environment such that the uptake of contaminants by fishes is significantly reduced

Fish Habitat Protection

- Halt cumulative incremental loss and degradation of fish habitat, and reverse where possible, as required by fishes

Fish Access

- Improve access to spawning and nursery habitat in rivers and coastal wetlands for native and naturalized fish species

Habitat Impacts of Invasive Species

- Prevent the unauthorized introduction and establishment of additional non-native biota into the Lake Erie basin enabling the food web to be dominated by native and naturalized species.

International Mediation of 2004 Lake Erie Walleye Total Allowable Catch

Walleye and yellow Perch are managed on the basis of total allowable catches (TAC) portioned out to each jurisdiction by the LEC. The lakewide TAC for walleye is determined through the scientific recommendations of the walleye task group, and the deliberations of the LEC. When consensus on the TAC can not be reached by the committee, dispute resolution procedures are available that can help facilitate a final decision. In the case of walleye, this occurred in 2003–2004 with respect to the TAC for 2004. Below is an outline of the process and the outcomes.

In 2001, the LEC agreed to reduce walleye harvest by 56%. This meant Ontario's commercial walleye quota was reduced by 56%. It stayed unchanged for 2002 and 2003.

At their 2003 annual meeting, the LEC agreed to reduce walleye harvest a further 40-60% in 2004. It became apparent to Ontario over the summer of 2003 that US agencies proposals to their angler harvest ranged from 0 to 35%. Additionally, fisheries assessments carried out in the late summer of 2003 indicated that that years production of young walleye was one of the strongest on record, meaning that drastic cuts in TAC were not required to conserve the fishery. Therefore, Ontario countered with a variety of proposals that included reducing commercial walleye quota by 20%. The US agencies rejected this proposal and continued to demand that Ontario reduce its harvest by 40-60%.

To facilitate a solution to this impasse, the GLFC arranged a mediated session for the LEC on February 4, 2004. At the hearing, the mediators asked if Ontario would accept a 27% reduction, and we said 'yes'. Two mediators were used, one from a US agency, the other an ex-official of the Department of Fisheries and Oceans.

The mediators provided a written report that had a number of recommendations, including Ontario to make a 27% reduction in the 2004 commercial walleye quota.

Although the recommendations from the mediators were non-binding, Ontario abided by the recommendations. 2004 Quotas were set at 30% less than in 2003. To help facilitate this reduction, Ontario also implemented a spring closure for the walleye recreational fishery.

St. Clair System Fish Community Goal and Objectives

Lake St. Clair, the Detroit River, and the St. Clair River fall within the jurisdictions of the State of Michigan, and the Province of Ontario. This requires these jurisdictions to manage the biotic and abiotic resources of these water bodies jointly. To this end, in 2003, Michigan and Ontario finalized their Fish-Community Goals and Objectives for these three water bodies. This process was facilitated by the GLFC, under the auspices of the Joint Strategic Plan for Fisheries Management. This plan sets out the requirements for each of the Great Lakes to have a Fish Community Goals and Objectives document.

In Ontario, public consultation and input was sought and obtained for the Fish Community Goal and Objectives by posting the document on the Ontario Government's Environmental Bill of Rights website. An electronic version of this draft document[6] can be found on the GLFC website www.glfc.org. The document is in the final edit prior to publication and printing.

The Lake St. Clair and Connecting Waters Fish Community Goal Task Group was charged by the LEC with defining fish community goals for Lake St. Clair and connecting waters. At its initial meeting, the task group agreed that the scope of reference for the fish community goal and objectives would include Lake St. Clair, the St. Clair and Detroit Rivers hereinafter called the St. Clair System. It was agreed that the task group would recommend fish community objectives for the St. Clair System as a whole rather than separate objectives for Lake St. Clair and the St. Clair and Detroit Rivers.

The task group has prepared the following candidate fish community goal and recommends that it be adopted by the Lake Erie Committee:

- To ensure a diverse balanced fish community supported by a healthy ecosystem with percids, centrarchids, and esocids as top predators based on a foundation of self-sustaining stocks and provide an optimum contribution of fish, diverse fishing opportunities and associated benefits to meet societal needs.

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[6] MacLennan, D.S. and Haas R.C., G. Towns, M.V. Thomas, E. Roseman, J. Francis, J. Brauncheidel, L. Halyk, D. Hector, B. Locke, R. McGregor, M. Morencie, A. Murray. 2003. Fish- community goal and objectives for Lake St. Clair, St. Clair River, and Detroit River (St. Clair System). Great Lakes Fish. Comm. Spec. Pub. Pp 44.

This draft document presents information on the fish community of the St. Clair System providing trophic status, historic and recent harvests. It also outlines fish community management principles and recommended objectives for the management of the St. Clair System fish community. It is intended to be dynamic, requiring updates as ecosystem changes occur and research data become available.

The Strategic Great Lakes Fisheries Management Plan (SGLFMP) (GLFC 1997 Revision[7]) goal statement was used as a basis in formulating a specific goal for the St. Clair System. The historical role of percids, centrarchids, esocids, and salmonines and the more recent fisheries dominated by walleye, smallmouth bass, and muskellunge as top predators in the system both in the sport and commercial fisheries led to a specific focus on a diverse community with these species as top predators. It was recognized that the fish community is supported by naturally reproducing fish species and a healthy ecosystem is essential to maintaining natural stocks. We agree with the Costanza and Mageau (1999)[8] definition of a healthy ecosystem as one that is sustainable, or able to maintain its structure and function over time, in the face of external stress.

Fish community objectives for the St. Clair System and objectives for selected trophic components of the fish community are presented below. There are major obstacles preventing the development of quantifiable objectives at the present time. These include the lack of a complete and annual creel survey, unknown population numbers for most species, incomplete understanding of the effects of exotic species, ongoing and confounding effects of changing water levels and climate on the fauna and flora, unknown impacts from pollutants and many more information gaps. These data gaps restrict our ability to predict fish community responses to both intentional and unintentional man-induced changes. Therefore, in light of the uncertainty associated with quantified species objectives, the following objectives are intentionally qualitative.

General Fish Community Objectives

- Protect and restore fisheries habitat in the St. Clair System while maintaining the natural variation in the composition, structure, and function of aquatic habitat in the St. Clair System.
- Maintain a diverse fish community composed of self-sustaining populations.
- Manage exploitation of fishable stocks to maintain self-sustaining status while optimizing benefits to society.
- Reduce contaminants in all fish species to levels below consumption advisory levels
- Prevent unintentional introduction of exotic species.

Specific Fish Community Objectives

The abundance and distribution of fish species within the St. Clair System varies spatially and temporally, on both a seasonal and annual basis. While these changes represent variation in the structure of the fish community, the function of the ecosystem has remained remarkably stable. For example, walleye, muskellunge and smallmouth bass, in combination, have sustained an ecological function as important piscivores, despite changes in their habitat, forage patterns, and relative abundance over the last 30 years. We have developed objectives for trophic groups of fish within the St. Clair System, by classifying fish species into functional groups based on adult foraging behaviour. The trophic groups are piscivores, benthivores/omnivores, and planktivores. Two additional groups were included to address species of special concern (restoration/protection species) and salmonines.

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[7] Great Lakes Fishery Commission. 1997. A Joint Strategic Plan for Management of Great Lakes Fisheries. Ann Arbor, MI.

[8] Costanza, R., and M. Mageau. 1999. What is a healthy ecosystem? Aquatic Ecol. 33:105-15.

Piscivores

- Maintain self-sustaining populations and facilitate optimum use of favorable habitat by predators such as walleye, muskellunge, northern pike, longnose gar (*Lepisosteus osseus*), largemouth bass (*Micropterus salmoides*), smallmouth bass, and yellow perch to fulfill piscivore functions in the ecosystem and provide quality fishing opportunities.

Walleye, smallmouth bass, and esocids are dominant predators and provide an important community function by exerting a regulatory influence on the abundance of other species in the ecosystem. Individually they support significant components of the angler fishery (effort and catch) and collectively represent approximately 70% of angler effort and 40% of the catch (MacLennan 2003)[9].

Walleye

Walleye stocks in Lake St. Clair support significant native and sport fisheries within the lake and its tributaries and are exploited by a commercial fishery in southern Lake Huron. From the late 1970's through the 1980's, the walleye fishery in the Ontario waters of Lake St. Clair supported an average annual May to August angler effort of 290.00 rod-hours, catch and harvest of 103,150 and 92,800 fish, yield of 0.67 kg/ha (0.6 lb/ac) and catch rate of 0.37 fish/rod-hour (OMNR 1990)[10].

The abundance, age structure, and distribution of walleye stocks in Lake St. Clair have undergone significant change in the last 30 years, particularly in Ontario waters. Ontario indices of relative abundance from index trapnetting and angler surveys and diaries indicated that adult walleye abundance was low during the early 1970s, then doubled in the late 1970s where it remained relatively high through the 1980s. A very strong 1977 year-class initiated the increase with very strong year-classes in 1980 and 1982 followed by strong year-classes in 1984-86 building the population. Through the 1980's, walleye population levels were possibly at one of the highest levels recorded.

During the 1990s, a significant and rapid decline in walleye stocks occurred, particularly in Ontario waters with indices of relative abundance from index netting and sport fishery surveys dwindling to between one half and one quarter of the previous 20 year average (OMNR, unpublished data). The structure of Ontario walleye stocks also exhibited a change with mean age of walleye caught in index netting increasing after 1987. Declining population abundance associated with a progressive shift to older fish was symptomatic of an extended period of poor recruitment. Mean annual catch of yearling walleye in Ontario index trapnets confirmed that poor year-classes had occurred from 1987 to 1999. Thus, poor recruitment appeared to be an important factor in the significant and progressive decline of adult walleye abundance in the Ontario waters of Lake St. Clair during the 1990's.

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[9] MacLennan, D.S. 2003. Summer angler fishery survey in the Canadian waters of Lake St. Clair, 2002. Ontario Ministry of Natural Resources. Lake Erie - St. Clair Fisheries Assessment Unit Summary Report, 2003 (in prep.).

[10] (OMNR) Ontario Ministry of Natural Resources. 1990. Lake St. Clair Fisheries Report 1989. Lake Erie Committee Meeting, GLFC, Ont. Min. of Nat. Res.

Catch-at-age-analysis, and tagging studies of the Lake St. Clair and Thames River spawning stocks indicated that survival was high (68%) and exploitation rate low (7.5%) during the 1980s. More recent values are not available, but major declines in fishing effort in the 1990's for walleye suggests exploitation in the 1990's would have been low. These observations indicated that exploitation was not likely a major factor contributing to low walleye recruitment.

White perch, a potential predator on walleye eggs and young walleye, colonized Lake St. Clair in 1977 and became the most abundant species in Ontario index catches in 1987. The reported interaction of white perch with walleye in the Bay of Quinte and the timing of their colonization in Lake St. Clair supported speculation that white perch could have been a factor in the poor recruitment of walleye through competition, if not direct predation. Roseman (2000)[11] found that white perch were the most important predator of walleye eggs on Lake Erie reefs during 4 of 5 years studied in the late 1990's. Schaeffer and Margraf (1987)[12] found that the exotic white perch were consuming large numbers of walleye eggs on migratory spawning grounds in the Sandusky River, Ohio, 45 km (28 mi) upstream from Lake Erie. However, the decline in white perch abundance in the late 1980s and early 1990s, concurrent with that of walleye, suggests white perch may have had little influence on walleye recruitment, at least in the 1990's. Muskellunge and smallmouth bass abundance increased dramatically after the late 1980s with their populations doubling or tripling by the late 1990s based on changes in angler and index netting annual indices of abundance data. This was suspected, but not determined, to have increased predation mortality on juvenile walleye, the segment of the population experiencing low survival, resulting in poor walleye recruitment. It has been observed in the past fish community of Lake St. Clair (e.g., 1940s and 1950s), and in other lakes (Krishka et al. 1996)[13], that when habitat or other conditions favoured increased abundance of muskellunge and smallmouth bass, walleye abundance was low.

Zebra mussel colonized Lake St. Clair in the late 1980s, resulting in significant ecological changes about the same time that walleye exhibited reduced abundance and poor recruitment. Prior to zebra mussel colonization, water transparency in the Ontario waters of Lake St. Clair was relatively consistent and low, with Secchi disc depth varying from 1 to 2m (3.3 to 6.6 ft), with an average of 1.4m (4.6 ft). These conditions offered ideal habitat for walleye which were ubiquitous in distribution (MacLennan 1994)[14]. After zebra mussel colonization, water transparency and Secchi disc depth increased 2-3 fold and exceeded 4.0m (13.1 ft) in many areas rendering these areas less ideal for walleye. Tag recoveries of Thames River walleye, the primary spawning stock in Lake St. Clair, indicated a change in the distribution of walleye both within Lake St. Clair and between its connecting waters. Walleye tagged in 1980-82 (pre-zebra mussel) were recovered from many areas in Lake St. Clair and in about equal proportions from Lake St. Clair (52% of recoveries) and the St. Clair River and lower Lake Huron (48% of recoveries). After zebra mussel colonization, walleye tagged in 1993 were primarily recovered in association with the deep shipping channel in the center of Lake St. Clair with Lake St. Clair contributing fewer recoveries (31%) compared to the St. Clair River and lower Lake Huron (69% of recoveries). Emigration of walleye to adjoining waterbodies, representing a 42% drop in the proportion of walleye recoveries from Lake St. Clair, would account for the fairly rapid decline in walleye stocks in Lake St. Clair after 1988. Optimal habitat volume for walleye had been significantly reduced in Lake St. Clair, resulting in a modified (confined) distribution within the lake and emigration out of the lake. Emigration of walleye to adjoining waterbodies in the early 1990's with poor recruitment through the 1990's appear to be primary factors in the significant decline of walleye in the Ontario waters of Lake St. Clair during this period.

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[11] Roseman, E. F. 2000. Physical and biological processes influencing walleye early life history in western Lake Erie. Doctoral dissertation. Department of Fisheries and Wildlife, Michigan State University, East Lansing, MI.

[12] Schaeffer, J. S. and F. J. Margraf 1987. Predation on fish eggs by white perch, *Morone americana*, in western Lake Erie. Environmental Biology of Fishes, Vol. 18, No. 1, pp. 77-80.

[13] Krishka, B. A., R. F. Cholmondeley, A. J. Dextrase, and P. J. Colby. 1996. Impacts of introductions and removals on Ontario percid communities. Percid Community Synthesis, Introductions and Removals Working Group, Ont. Min. Nat. Resour. Peterborough. 111 p.

[14] MacLennan, D. S. 1994. Impact of zebra mussel on the abundance and distribution of walleye in Lake St. Clair. International Association for Great Lakes Research Program and Abstracts, 37th Conference June 5-9, 1994, Windsor.

It has been concluded that many factors were influencing low walleye recruitment and decreased abundance from the late 1980's through the 1990's. The least significant factor was likely exploitation, while the most significant were likely the fish community and habitat changes associated with the invasion of zebra mussels.

To ensure that self-sustaining stocks of walleye are maintained, it is critical that the importance of discrete walleye stocks be recognized. We must also recognize the presence of transient walleye from Lake Erie. Tagging and genetic evidence indicate that there is considerable movement and interchange of walleye between the St. Clair/Detroit River system and Lakes Huron and Erie (Todd and Haas 1993[15]; Thomas and Haas 1998[16]). Recruitment of walleye in Lake St. Clair can be highly variable with a noticeable lack of strong year-classes since 1986 (MacLennan and Bryant 1990[17]; Thomas and Haas 1998[14]). Timely and reliable estimates of abundance will be required on a regular basis to support prediction of future walleye abundance in the St. Clair System. Therefore, an understanding of the proportional stock contribution and recruitment dynamics of walleye in the St. Clair System are needed to develop adequate quantifiable objectives and support effective management of this species. Monitoring of predator populations is also desirable to ensure that community changes are detected soon enough to allow timely regulation changes.

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[15] Todd, T.N. and R.C. Haas. 1993. Genetic and tagging evidence for movement of walleyes between Lake Erie and Lake St. Clair. Journal of Great Lakes Research 19:445-452.

[16] Thomas, M. and R. Haas. 1998. Status of the fisheries in Michigan waters of Lake Erie and Lake St. Clair. Michigan Department of Natural Resources, Lansing, MI. 18 pp.

[17] MacLennan, D. and B. Bryant. 1990. State of the Lake Report for: Lake St. Clair, St. Clair and Detroit Rivers. GLFC Special Report, Ann Arbor, MI. 13 pp.

Smallmouth Bass

Smallmouth bass represent a significant component of the recreational fishery of Lake St. Clair and the Detroit River. Prominence of smallmouth bass in the fish community and fishery has significantly increased during the 1990's. From the late 1970's through the 1980's, the smallmouth bass fishery in the Ontario waters of Lake St. Clair supported an average annual June to August angler effort of 26,500 rod-hours, catch and harvest of 14,300 and 7,800 fish, yield of 0.064 kg/ha (0.06 lb/ac) and catch rate of 0.36 fish/rod-hour (OMNR, unpublished data). In the 1990's a dramatic increase occurred with annual angler effort (55,900 rod-hours) and average catch rate (.636 fish/rod-hour) doubling, while harvest (20,000 fish) and yield (0.19 kg/ha (0.17 lb/ac)) tripled and catch (55,700 fish) quadrupled. The growing popularity of bass fishing in the 1990's has given rise to a burgeoning pre-season fishery with concerns for smallmouth bass mortality (hooking) and reproductive loss (by removal of guarding males off nests). However, smallmouth bass stocks appear to have been resilient to this. Indices of relative abundance for smallmouth bass in Ontario Ministry of Natural Resources (OMNR) fall index trapnet catches had increased, suggesting a doubling of the stock from the 1980's to the 1990's. The population appeared to be supported by a number of large year-classes that emerged in the late 1980's and through the 1990's. Trophy size individuals had become increasingly common during the 1990's. The MDNR Master Angler Program saw a progressive increase in smallmouth bass entries from Lake St. Clair through the 1990's, with the most pronounced increase occurring after 1995. The increase in occurrence of large smallmouth bass was attributed to both an increase in survival, and thus, the number of older smallmouth bass, along with an increase in individual growth rates.

The enhancement of smallmouth bass stocks in Lake St. Clair during the 1990's can be linked to a number of factors. The increase in water transparency and attendant macrophyte density for Lake St. Clair in the 1990's contributed more favorable habitat for smallmouth bass. An increase in the condition, survival and abundance of benthivores, including smallmouth bass, was predicted as a consequence of the shift in the trophic energy in Lake St. Clair due to colonization by zebra mussel. Large numbers of crayfish and round goby (an exotic species) are consuming the abundant zebra mussel and adding to the diet of smallmouth bass.

Muskellunge

The Lake St. Clair muskellunge population is one of the few remaining self-sustaining populations in the Great Lakes. Muskellunge currently support a significant and growing recreational fishery in Ontario and Michigan waters of Lake St. Clair. In 1989, for the Ontario waters of Lake St. Clair, muskellunge represented 10 % of the total summer fishery effort with 34,000 rod-hours and catch of 2,000 fish (MacLennan and Bryant 1990[15]), which in 2002 increased to 22 %, 43,000 rod-hours and 7,200 fish, respectively (MacLennan 2003[7]).

An increase in the Ontario and Michigan minimum size limit from 76 to 102 cm (30 to 40 inches) in 1987 along with a growing "catch and release" ethic appears to have afforded important protection to the muskellunge stocks in Lake St. Clair (MacLennan 1996[18]) and contributed to more than a doubling in stock size during the 1990's. Changes in the habitat of

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[18] MacLennan, D. S. 1996. Changes in the muskellunge fishery and population of Lake St. Clair after an increase in the minimum size limit. P19-27. *In* S.J. Kerr and C. H. Olver, [eds.]. Proceedings of the "Managing Muskies in the '90s" Workshop. Ontario Ministry of Natural Resources and Muskies Canada Inc. Kemptville, Ontario

Lake St. Clair, favorable to muskellunge also occurred after 1987. The density of musk grass (*Chara* spp.), a primary substrate for spawning muskellunge (Dombeck et al. 1984[19]) had dramatically increased over extensive areas of Lake St. Clair based on macrophyte surveys comparing the mid 1980's to 1990's (MacLennan 1997[20]). Overall macrophyte density in the Ontario waters had increased 5 fold, providing both nursery and adult habitat. Muskellunge were not only more abundant in the lake, but more ubiquitous in distribution. While there has been concern that the increase in muskellunge density may exceed availability of abundant preferred food, recent evidence suggests growth rates remain high (OMNR, unpublished data). The management objective to provide trophy muskellunge fishing opportunities (fish greater than 16 kg (35.3 lbs) and 102 cm (40 inches)) from a stable self-sustaining population appear to have been realized through the 1990's.

Yellow Perch

Yellow perch have been an important component of the recreational fishery in the St. Clair System for decades. Johnson (1977)[21] found the yellow perch population of Lake St. Clair remained relatively unchanged from 1970 to 1976. Henderson and Nepszy (1988)[22] documented a decline in abundance from 1969 to 1971, a low period during the 1970's, followed by increased abundance from 1980 to 1984. Yellow perch catch rates (number per net night) in OMNR fall index trapnets increased 30% at the northeast site but decreased 80% at the southeast site from the 1980's to the mid 1990's, suggesting a shift in distribution. Ontario yellow perch angler effort doubled and catch rates increased 40% in the late 1990's'compared to the 1980's (OMNR, 2000[23]). OMNR trapnet and MDNR trawl catches have indicated a number of strong year classes were produced in the 1990's (1991, 1993, 1994, 1995, and 1998). Yellow perch populations typically benefit from increased macrophyte abundance as occurred during the 1990's. Lake St. Clair yellow perch exhibited increased size at age in the early 1990's compared to the 1980's in Ontario trapnets and growth rates above the Michigan average and higher than that observed for Saginaw Bay or Lake Erie's western basin. Synnestvedt (1997)[24] found that Lake St. Clair yellow perch benefited from a diet rich in invertebrates, especially amphipods and mayflies (*Hexagenia* spp). Griffiths (1993)[25] found higher abundance of the amphipod *Gammarus* after zebra mussel colonization of Lake St. Clair. Reduced ice cover on Lake St. Clair during the 1990's probably resulted in lower exploitation pressure on yellow perch, a principle species in the winter fishery.

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[19] Dombeck, M. P., B. W. Menzel and P. N. Hinz. 1984. Muskellunge spawning habitat and reproductive success. Trans. Am. Fish. Soc. 113: 205-216.

[20] MacLennan, D. S. 1997 Distribution and relative abundance of submerged aquatic macrophytes and fish in Lake St. Clair's nearshore Canadian waters in the mid 1980's and 1990's. Lake St. Clair Fisheries Assessment Unit report, Ontario Ministry of Natural Resources.

[21] Johnson, D.A. 1977. Population dynamics of walleye and yellow perch in Lake St. Clair, especially during 1970-76. Can. J. of Fish. and Aquatic Sciences 34:1869-1877.

[22] Henderson, B. A. and S. J. Nepszy. 1988. Recruitment of yellow perch (Perca flavescens) affected by stock size and water temperature in lakes Erie and St. Clair, 1965-85. J. Great Lakes Res. 14(2):205-215.

[23]

[24] Synnestvedt, S. 1997. The importance of large benthic invertebrates to the diet and growth of yellow perch in Lake St. Clair, Michigan. Fisheries Division Research Report #2031. Ann Arbor.

[25] Griffiths, R.W. 1993. Effects of zebra mussels (Dreissena polymorpha) on the benthic fauna of Lake St. Clair. Pages 415-437 *In* Zebra Mussels: Biology, impacts, and controls. T. F. Nalepa and D.W. Schloesser, Eds. Lewis Publishers, Ann Arbor, MI.

Benthivores/Omnivores

- Maintain abundant populations of native benthivores/omnivores to provide diverse fishing opportunities and support abundant predator species.

The benthivore/omnivore guild of the Lake St. Clair fish community is a critical component of the food web, linking benthic production to piscivore production. Diverse and abundant populations of large, long-lived benthivores stabilizes energy cycling, enhancing the stability and resilience of the system. The rich benthic fauna of Lake St. Clair supports abundant populations of benthivores and omnivores. These include both recreationally (rock bass (*Ambloplites rupestris*), channel catfish (*Ictalurus punctatus*), pumpkinseed (*Lepomis gibbosus*) and commercially (lake sturgeon) important species. Other benthic species such as freshwater drum (*Aplodinotus grunniens*), white perch, quillback (*Carpiodes cyprinus*), silver redhorse (*Moxostoma anisurum*), shorthead redhorse (*Moxostoma macrolepidotum*), trout-perch (*Percopsis omiscomaycus*), logperch (*Percina caprodes*), and johnny darter (*Etheostoma nigrum*) also contribute to the diet of larger piscivores in the system. Lake sturgeon will be further addressed in the restoration/preservation species section below.

Channel Catfish

Channel catfish are one of the last species still commercially fished on Lake St. Clair. The species remains underutilized by the recreational fishery. Based on MDNR trap net and trawl catches, the channel catfish population of the lake in the early 2000's appears to be of low density, and dominated by old, large individuals. Individual fish exceeding 71 cm (28 inches) in total length are not unusual. The potential exists for development of a trophy channel catfish sport fishery, but angler interest is lacking in Michigan possibly due to current consumption advisories.

Planktivores

- Maintain self-sustaining populations of planktivores at a level for self-sustaining predator populations and for utilization by man e.g., harvest of bait fish.

Although the Lake Huron water mass that dominates much of Lake St. Clair is relatively plankton poor, planktivores such as emerald shiner, alewife, gizzard shad (*Dorosoma cepedianum*), and rainbow smelt are present in the St. Clair System. These species provide an important linkage in the food web between the lower trophic levels (algae and zooplankton) and the upper trophic levels (piscivores).

Spottail Shiners and Mimic Shiners

Both spottail and mimic shiners are commercially harvested from Lake St. Clair and sold as live bait. The impact of the commercial harvest on the lakewide abundance of these species is unknown. The economic value of the commercial harvest is likewise unknown.

Restoration/Protection Species

- Maintain and restore self-sustaining populations of lake sturgeon and manage other rare and endangered species to the extent they become significant factors in the St. Clair System wherever possible and such that no more species become significant factors in the

St. Clair System wherever possible and such that no more species become extinct in the system.

Interest in the status of lake sturgeon in the Great Lakes basin has been increasing within all natural resource agencies involved in fisheries management in the 1990s. Federal, state, and provincial agencies have initiated status surveys and are in various stages of development of recovery and management plans for waters under their jurisdiction (McClain et al. 1996)[26]. Recent research efforts by MDNR, United States Fish and Wildlife, United States Geological Survey, and OMNR agency staff have documented the presence of a substantial self-sustaining lake sturgeon population that resides within and migrates through the St. Clair System. Continued research efforts and the development of a comprehensive recovery and management plan for lake sturgeon in the St. Clair System will facilitate the maintenance of self-sustaining populations at levels to serve as a potential source of fish and/or eggs for future rehabilitation efforts in other waterbodies.

Restoration of lake whitefish and lake herring populations would enhance the diversity of the fish community in the St. Clair System as well as the available fishing opportunities. However, physical and climatological changes likely have resulted in temperature regimes not appropriate for these cold water species to survive year around in the St. Clair System. Similarly, the environmental conditions that supported sauger through the early 1900's are no longer present, and sauger restoration may not be possible.

As of March 1999, the only endangered species recently collected in the St. Clair System has been the river darter (*Percina shumardi*). Threatened species, other than lake sturgeon, recently collected include the eastern sand darter (*Ammocrypta pellucida*), mooneye (*Hiodon tergisus*), and channel darter (*Percina copelandi*). While most of these species do not play a major role in the fish community, their presence does serve to maintain species diversity in the system. The populations present could also serve as a source to repopulate other areas where they have disappeared. Monitoring of these and any other endangered and/or threatened fish species found in the St. Clair System should continue to be a part of fish community sampling to detect variations in abundance due to the changing habitat and environmental parameters in the System.

Salmonines

- Maintain existing favorable habitat conditions for pacific salmon, rainbow trout, and brown trout.

The Detroit River and Lake St. Clair are not felt to be suitable for year round survival of salmonines and therefore have a limited role in the fish community. There is however a seasonal fishery for salmonines in the Upper St. Clair River that is believed to be largely dependent on hatchery reared fish released at numerous locations throughout the Lake Huron Basin. While it is recognized that substantial fishing opportunities are provided by this fishery, the impact of these planted fish upon the native fish community should be determined by monitoring their abundance and conducting diet studies.

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[26] MacClain, J.R., L. Mohr, R.C. Haas, M. Thomas, C. Lowie, D. MacLennan, and D. Davies. 1996. Summary of 1996 activities of the interbasin lake sturgeon work group in waters of Lake Huron, St. Clair, and Erie. 11 pp.

Impediments and Issues to Attainment of Fish Community Goal

The major issues which may serve as impediments to attainment of the fish community goal and objectives by producing negative impacts on the fish community are identified as follows:

1. Contaminants; both direct effects upon fish health and indirect effects upon fishing activities via consumption guidelines and negative publicity that inhibit full utilization of fisheries resources in the St. Clair System.
2. Loss of habitat and productivity due to shoreline alterations, water level fluctuations, dredging and deposition of dredged materials reduce the potential productive capacity of habitats in the St. Clair System.
3. Exotic species invasions have altered the fish community and nutrient cycling pathways in the St. Clair System. Examples include the white perch, round goby, planted salmonines, zebra mussel, and the possible future invasion of ruffe in the system. Diet studies and knowledge transfers will be important to reveal the trophic interactions and significance of these exotic organisms on the population and community dynamics of indigenous species in the system.
4. Water quality degradation from municipal, industrial, and agricultural sources that impact the aquatic community.
5. Inadequate information and resources for management agencies to conduct programs and measure progress towards objectives. This is particularly acute in regard to the void of information available for Ontario waters of the St. Clair and Detroit Rivers which not only precludes assessment of progress towards objectives, but also imposes difficulty for the establishment of quantifiable fish species objectives in these waters. Timely and reliable indices of recruitment and abundance are needed on a regular basis to support effective management and rehabilitation of the fish community in the St. Clair System.
6. Information on exploitation is inadequate. Recreational fishing pressure in the St. Clair System is very large, exceeding 4 million angler hours in Michigan waters alone in 1983 and 1984 (Haas et. al. 1985)[27]. Creel surveys conducted at regular time intervals are needed to provide a reflection of changes in fish community composition as well as the desires of recreational fisherman.
7. Potentially significant biodiversity and ecological changes have occurred in Lake St. Clair during the 1990's that may have implications on the long-term stability of the ecosystem. Colonization of Lake St. Clair by zebra mussel in the 1990's resulted in extirpation of the 18 long standing native unionid species that were present in 1986 (Nalepa et al. 1996)[28]. The functional mussel community has changed from a slow-growing, stable community with a relatively minor influence on the ecosystem to a community consisting of a single taxon with a relatively rapid turnover rate that strongly affects ecosystem dynamics and may predispose the ecosystem to other perturbations. The implication of this ecosystem change on ecological health (stability) needs to be monitored and better understood.

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[27] Haas, R.C., W.C. Bryant, K.D. Smith, and A.J. Nuhfer. 1985. Movement and harvest of fish in Lake St. Clair, St. Clair River, and Detroit River. Michigan Department of Natural Resources, Final Report, Winter Navigation Study, US Army Corps of Engineers. Ann Arbor.

[28] Nalepa, T. F., D. J. Hartson, G. W. Gostenik, D. L. Fanslow, and G. A. Lang. 1996. Changes in the freshwater mussel community of Lake St. Clair: from Unionidae to *Dreissena polymorpha* in eight years. J. Great Lakes Research 22(2):354-369. International Association of Great Lakes Research.

Walleye Management Plan

The following is a summary of the primary components of the LEC's Walleye Management Plan. The full document is currently under final review, and will be published by the LEC in 2005.

Lake Erie walleye is of enormous economic importance to all LEC jurisdictions. It is therefore imperative that any management objectives for this species be aimed first at the sustainability of the population and second to maximize societal benefit for all jurisdictions. Further, the fishery must be allocated fairly and in a transparent and biologically justifiable fashion. In order to achieve this, managers require a decision making process that has clear objectives both for the fish population and the harvests associated with it. These objectives need to be supported by a management regime that will ensure that resource sustainability is maintained, that the walleye population continues to support fisheries of a high quality, and is in keeping with the LEC's Fish Community Goals and Objectives for Lake Erie. The WMP document presents a brief recent history of walleye management on Lake Erie, the current status of this important species, fishery and fish population objectives, and management tools for the LEC will use to ensure that the objectives are met.

Scope and Purpose of the Walleye Management Plan

This plan establishes fishery sustainability and quality objectives that the LEC will employ as a basis for walleye management. This plan focuses primarily on the walleye stocks that spawn on shoals and in tributaries of the western basin, and generally inhabit the west and central basins of Lake Erie. This is the primary population of interest to the LEC management exercise as it provides most of the benefits to users throughout Lake Erie. There are additional stocks within the lake, and these are found east of Long Point, in the eastern basin. Catch-at-age modelling and population estimates for this eastern population remain problematic, but it is clear that the population is small relative to the western population.

The WMP takes advantage of lessons learned and models developed during the previous 5 years. This management plan will form the basis for all future work towards managing walleye stocks in Lake Erie. This plan will be dynamic and continue to change with advances in assessment technology and fisheries theory.

It will be important for future sustainability of walleye that this population has an age structure that allows it to consistently provide stable fisheries and sufficient spawner biomass. In order to accomplish this, a more thorough understanding of population dynamics is necessary so that effective management actions can be implemented accordingly. The LEC and the Walleye Task Group (WTG) are working to increase understanding of population dynamics such as the walleye stock-recruit relationship, quantifying uncertainties in the models and evaluating risk strategies for various rates of exploitation, and mortality. Research initiatives are underway to delineate stocks and understand the influences of stock size and environmental variability on percid recruitment. These efforts, and others, such as the Decision Analysis (DA) initiative strengthen the WMP in that they inform managers as to the options available to them, and help them to understand the potential effects of their management actions.

Central to the WMP are two main components. The first are population objectives that define the biological and fishery quality characteristics that the LEC, in cooperation with stakeholders, has set for the Lake Erie walleye population. The second is an exploitation policy that has been designed to help meet these objectives while at the same time maximize the economic benefit of the walleye fishery to stakeholders. This exploitation policy does so by marrying state of the art population and harvest simulation modelling with lessons learned from other fisheries and the recent history of walleye management on Lake Erie.

Walleye Fishery and Fish Population Objectives

The LEC manages the entirety of the Lake Erie resource using the Fish Community Goals and Objectives for Lake Erie. As a terminal predator, walleye are a key component of the Lake Erie ecosystem, and any management of this species must take this fact into consideration. For example, mismanagement of this species, to either end of the population abundance spectrum, could potentially lead to instability in the fish community, and have subsequent negative impacts on the integrity of the ecosystem or on other economically important species. Moreover, as an important commercial food fish, and a desirable sport fish species, walleye need to be managed for these uses as well. Ideally, this management objective should occur within the context of first sustainability, second ecosystem integrity, and economic benefit third.

Sustainability Thresholds for Walleye

Defining a minimum population size (a level of abundance from which a population can not recover in a reasonable time frame) is difficult if not impossible. For walleye in Lake Erie, the relationship between numbers or biomass of spawners and subsequent recruits is typically weak, with environmental influences greatly masking the effects of stock size on recruitment. In the case of other fisheries, the only time these thresholds are observed is after they have been exceeded. It may be simpler, therefore, to set a level for sustainability at a population size that causes fisheries to take on negative attributes. These attributes can include, but are not limited to a reduction in catch rates that lead to declining angler interest, or make the economics of the commercial fishery problematic. Additionally, when populations are reduced to low levels of abundance, they tend to take on other attributes that increase the risk of overexploitation. These include a reduced number of year classes causing a simple age structure that can lead to low levels of spawner biomass, or dependence of fisheries on single year classes. This can cause TACs and harvest to vary wildly on an annual basis (particularly at fixed exploitation rates), and is extremely risky from a stock conservation standpoint.

The population abundance of walleye in recent years (1999–2000) was a level of abundance that created the negative attributes described above. Both commercial and sport fishery catch rates were at 10-year lows, and all jurisdictions had difficulty attaining their portions of the TAC. This year 2000 population level should be considered one which LEC should seek to avoid, and should employ strong management actions to do so. The LEC has determined that the population abundance observed in 2000 is a critical minimum for the quality of fisheries, and is problematic for the sustainability of the resource. Therefore, the LEC maintains that dramatic management action in the form of reduced harvest levels will be warranted should the population fall below this level.

LEC Fishery Goals and Objectives for Walleye

In order to ensure that the walleye population is sustainable and is of sufficient abundance to meet fishery quality objectives, the LEC has developed the following objectives:

- Maintain walleye catch rates at average or better levels,
- Maintain sport and commercial walleye harvest to average or better levels

To satisfy these objectives, the walleye population should have an average size of approximately 26-40 million fish. Additionally, the age and size structure of the fishery should be sufficient to promote migration of walleye towards the eastern basin of the lake, provide diverse fishing opportunities to anglers; and provide sufficient numbers of commercially desirable fish.

These objectives should be achieved when the population size is between 26 and 40 million fish, and the fishery is not dominated by only one year class. The following population abundance categories (for age 2 and older walleye) have been identified by the LEC:

• <15 million	Crisis
• 15-19 million	Rehabilitation levels
• 20-25 million	Low quality
• 26-40 million	Maintenance
• > 40 million	High quality

Ancillary management tools that act to promote genetic diversity, and generally act to buffer or enhance the effect of management actions should also be implemented, but due to the difficulty in measuring their impact (e.g. their place as a modifier of the spawner recruit relationship), the extent to which they should be employed can't be adequately described. Therefore, the LEC chose to focus on methods that could be simulated and/or reviewed within the context of contemporary knowledge of Lake Erie walleye.

In order to influence walleye population abundance to the extent that it is possible using direct management tools, it is clear that an exploitation policy should be central to any management plan for the species. This policy should do four basic things: ensure the sustainability of the walleye population, help to maintain walleye within the maintenance threshold set out by LEC, allow user groups to take advantage of large walleye populations, and be straightforward enough that its implementation will be simple to understand, and can rely on current stock status information.

To do these things, it is critical that the current knowledge of the walleye population be described and understood, and that past management actions be reviewed. Further, examining this information using simulation modeling in conjunction with decision analysis, it is possible to generally predict the impacts management actions have on the population that could be expected in the future. By doing so, an exploitation policy that fulfills the above four criteria can be created.

WMP exploitation policy

As discussed earlier in this document, the WMP seeks to set exploitation policy using both a historical approach (to examine empirical and theoretical ramifications of various levels of harvest) in combination with decision analysis and population simulation modeling (for policy evaluation). To do this, the LEC examined fishing rates that it has applied or observed for Lake Erie walleye, and looked to the literature for guidance. Simulation models from a Decision Analysis (DA) (see page 15) project then were used to evaluate and forecast the impact of the resulting policy.

The LEC walleye population objectives lend themselves well to exploitation policies that vary depending on population abundance estimates. The DA team, and the LEC have dubbed this type of approach a feedback approach. Feedback refers to the fact that the exploitation policy is informed by population abundance, is used to set exploitation rate, then is re-informed in the subsequent year by the new population abundance, and a new and different exploitation policy is set.

This approach enables the LEC to reduce fishing mortality when the population abundance is low and take advantage of periods of high abundance by increasing fishing mortality. Several approaches were discussed and or tested using simulation models using a variety of levels of fishing mortality. For example Figure 1 shows an early feedback policy tested by LEC and the DA team.

It was decided that empirically derived levels of fishing mortality (F) should be used to begin setting out the policy. Figure 1 uses a low level of F between 15 and 20 million walleye (approximately 0.2) that is comparable to the exploitation rates used during the CPMS. These levels of fishing mortality were sufficiently low that they arrested population decline, and all but eliminated the influence of harvest on the population. In contrast, the upper level selected for this early policy is set at a level corresponding to the maximum fishing rate on a Beverton-Holt curve. This level is the maximum that LEC feels is safe, and is an excellent analogue for an optimal maximum sustainable yield rate harvest. In the policy, levels of fishing mortality decrease from this high F with population size in steps (created by the population stages of the LEC policy) in order to promote population growth and maintain spawner biomass.

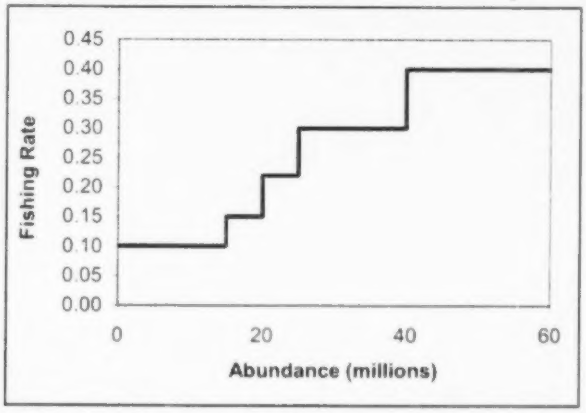

Figure 1. An early feedback policy tested and discussed by LEC. Notice that the steps on the curve approximate the changes from one population state to another (as described above).

This type of approach was ultimately rejected as there was some concern at LEC about the rapid changes in targeted fishing mortality that relatively small changes in abundance estimates would indicate. This would result in TACs that could vary wildly on an annual basis. Additionally, it is not uncommon for a subsequent year's population estimates to slightly revise past stock size estimates. This could result in rapid changes occurring in targeted fishing mortality that were found to be unnecessary in the year following allocation. This could have real economic ramifications for stakeholders, and would undermine the credibility of the process. Additionally, there was no mechanism to "decelerate" the levels of harvest when a transition level was being approached. It was also decided that fishing mortality rates above 0.39 are be excessive, and could compromise the broad distribution of benefits that are typically enjoyed as the walleye population peaks in abundance.

Upon further deliberation, the LEC described a feedback policy which is now referred to as the sliding F policy. The resulting policy is illustrated in Figure 2, and will be used for the foreseeable future by LEC to manage walleye.

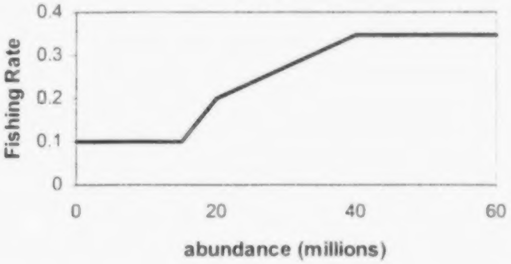

Figure 2. LEC sliding F policy for walleye management in Lake Erie.

This policy uses the mean targeted walleye fishing mortality (described in an earlier section) as the maximum F allowed, and employs it when the population exceeds 40 million fish. At 20 million fish, a value of 0.2 is used, and the resulting curve will be used to set fishing mortality levels on an annual basis. The lowest level of F in this policy is 0.1, and will be employed when the population falls below 15 million fish.

This exploitation policy was evaluated using the Decision Analysis simulation model, with the results considered favorable by the LEC with respect to its objectives. Table 3 summarizes the DA simulation outputs with respect to 6 parameters of interest that are key to understanding the impact of walleye exploitation policies on the population, and can be used to evaluate/compare different policies.

Table 3. Summary of DA simulation outputs for the LEC sliding F policy modified from.

Parameter	LEC Policy
Mean number of 2 year old and older walleye (over a 50 year simulation period)	47.4 M
Mean number of 4 year old and older walleye (over a 50 year simulation period)	15.8 M
Percentage years below 15 million walleye (over a 50 year period)	1.0%
Percentage of years that the population is less than 15 million walleye for greater than 3 years	4.0%
Percentage of years below 25 million walleye (over a 50 year period)	15.3%
Percentage of years that the population is less than 25 million walleye for more than 3 years (over a 50 year period)	11.5%

If the WMP exploitation policy works as it is intended, the walleye population abundance will remain within the maintenance zone most of the time, with variance from this state driven primarily bye short term fluctuations in recruitment. Any dramatic shift from this state will be driven primarily by changes in carrying capacity or other major ecosystem change. Because these changes typically occur over a span of years, the effect of the WMP can not be understood without the benefit of allowing those years to pass. Therefore, the true test of the policy will be to examine whether or not on average and over time, the abundance of walleye remained within the LEC maintenance range. This will then ultimately lead to a sustainable walleye population that on average provides excellent opportunities for both the recreational and commercial fisheries that utilize this wonderful fishery resource.

2004 Outreach Updates

Angler Outreach

For the eighth year, the LEMU hosted a series of meetings for sport fishers along the Lake Erie and Lake St. Clair shoreline.

Changes for 2004:	changed location of Brantford meeting to Caledonia new location for London meeting
2004 Attendance:	185

Simcoe – April 17, 2004

Attendance:	70 – best we have seen in Simcoe
Program:	East Basin Rehabilitation/Grand River Walleye; Long Point Bay Fisheries; Status of Fish Stocks; Sport Fishing Regulations; Enforcement Update; Angler Diary
Comments:	Why inner bay commercial fishers allowed to fish for yellow perch in spring? eliminate seine nets and go with hoop nets; anglers won't mind if there is balance between anglers and commercials How efficient is the Dunnville fishway? What is status of rainbow? Where are all the baitfish? Why do we allow trawlers to go through clouds of baitfish and wipe them out? Why can't we catch smelt anymore? Why can't we catch the predators? Question about bass and bass spawning in Nanticoke area

Port Colborne – April 27, 2004

Attendance:	21 – lowest attendance we have seen at this location
Program:	Introductions & Around-the-Room; Grand River Walleye; East Basin Rehabilitation Plan Update; Status of Fish Stocks; East Basin Angler Surveys; Sport Fishing Regulations; Angler Diary; COA Update; Enforcement Update; Botulism/Exotics/Dead Zone Update
Comments:	What is happening with smelt? Are commercial fishers waiting for east basin plan to end in 2004 so they can go back fishing? Did commercial fishers catch their 2003 quota? What backlash does Ontario get because of our commercial fishery? Does the occasional lawbreaking by commercial fishers cause Ontario problems with the US? Commercial fishers who repeat offend – why can't we suspend their licence? Why does Ohio have a trap net/seine net fishery and not a gill net/trawl fishery? Any plans to improve the Dunnville fishway? Where are the yellow perch? – can't catch them in the Port Colborne area Gov't does stuff backwards – when there was no pike, you could spear them; now that there are lots of pike, you can't What are walleye growth rates now vs. pre-zebra mussels? What are the factors that contribute to spawning success? Do we know?

What is status of COs working in east end of lake? What are plans for on-water checks this summer – didn't see the boat around last summer? Are the COs still partnering with the OPP?
Do we have GPS coordinates for international boundary – where can they be obtained?

London – April 28, 2004 *(UAW hall off 401)*
Attendance: 13
Program: Introductions & Around-the-Room; Thames River Walleye; Status of Fish Stocks; East Basin Update (Angler Surveys, EB Plan); Angler Diary; Sport Fishing Regulations; Enforcement Update; Botulism / Exotics / Dead Zone Updates
Comments: Can fish for bass in NY waters in spring – why not in Ontario?
Question about Thames river walleye transplanted to Fanshawe reservoir
Questions about largemouth bass in Long Point Bay – thick weeds preventing angling; Need for minimum size limit for bass on Inner Long Point Bay
Ice huts and March 15 deadline for removal – what do we do about huts left on ice after March 15?
Number of migratory bird deaths due to botulism compared to number of migratory bird deaths due to lead – need to ban lead blown out of proportion
Somebody (U of Windsor?) working on enzyme trap for gobies – is this a good thing, considering the number of gobies now in smallmouth bass diets ?

Caledonia – April 29, 2004
Attendance: 4
Program: East Basin Rehabilitation/Grand River Walleye; Long Point Bay Fisheries; Status of Fish Stocks; Sport Fishing Regulations; Enforcement Update; Angler Diary
Comments: Have they been able to figure out why walleye aren't using the fishway?

Wallaceburg – May 4, 2004
Attendance: 13 (5 Michigan), 2 MDNR
Program: Introductions & Around-the-Room; Status of Fish Stocks (walleye & yellow perch, forage fish); Thames River Walleye; Sport Fishing Regulations; Angler Diary; Lake St. Clair Fish Diseases; St. Clair System FCGOs; Dead Zone
Comments: What about cormorants and what are government plans to control them? Is Michigan more concerned with cormorant impacts on fish or on vegetation
Does the spring walleye closure in Lake Erie apply to commercial fishers?
Are there separate western, central and eastern basin walleye stocks? Not seeing walleye in the central basin like we used to – is it because commercial gill nets are blocking them?

Are contaminant levels in yellow perch being monitored, especially now that perch are feeding on gobies and zebra mussels?
What about smelt trawling and impacts on fish?

Windsor – May 6, 2004

Attendance: 64
Program: Similar to Wallaceburg meeting
Comments: Why can commercial fishers fish for walleye in spring and anglers can't?
Only way US can control Ontario gillnetting is by saying walleye (quota) is going down – it is a political game the US is playing? – there are a lot of walleye out there. Questions around commercial fishing in spring – inequity between fisheries. How are shares of walleye and yellow perch apportioned out in Ontario? How many smelt do the commercial fishery take
Do strong walleye year classes always follow cold winters
Discussion around Lake St Clair walleye regulations – 2 lines per angler, 15" minimum size limit, getting rid of 18" size limit, leave musky size limit at 42" or even go to 40".
What is thin red worm being found in flesh of yellow perch?

Commercial Outreach

In 2004, three commercial outreach meetings were held with members of the commercial fishing industry. The meetings were held in February at the Port Dover Fisheries Station, the Port Stanley Fire Hall, and the Wheatley Legion Hall. Attendance was very good from commercial fishers, representatives of the Ontario Commercial Fisheries' Association and the LEMU.

At each meeting the Lake Manager opened with brief comments about the state of the fisheries, issues of concern to commercial fishers, ongoing and future initiatives with the LEMU and the LEC. Specifically, updates were given on the LEC's conflict resolution session, the Fish and Wildlife Conservation Act hearing, the Coordinated Percid Management Strategy, the Canada-Ontario Agreement, and the East Basin Rehabilitation Plan.

Attendees were then given an opportunity to ask questions or provide comments into the state of the fisheries and management. In general, the commercial fishers were angry and disillusioned with the LEC's early announcement that walleye quota would be reduced in 2004. Fishers and processors stated that they thought the fisheries could withstand higher harvests and that their businesses were going to be in jeopardy if quotas were reduced in 2004. Some discussion centered on initial allocations of walleye and yellow perch.

At the meeting in Port Dover, commercial fishers expressed concern about angling tournaments taking place in the rehabilitation zone and asked what the approximate sport harvest was in the eastern basin. There was discussion at this meeting about the final year of the East Basin Rehabilitation Plan with commercial fishers asking the LEMU to clearly explain what target population abundances of fish are believed to provide good fisheries and fish populations in the east basin.

Other Outreach

West Elgin Nature Club, West Lorne February 19, 2004	25 people
Hully Gully Boathouse Sale, London	
Golden Horseshoe Outdoor Club, Hamilton April 19, 2004	
OFAH Zone J meeting, Chatham April, 2004	
Port Burwell Provincial Park July 7, 2004	40 people
Rondeau Provincial Park NHE evening program July 14, 21- 2004	56 people
Council of Canadians – London Chapter's Water campaign November 10, 2004	10 people

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Blenheim
Scott McCharles, Intelligence Officer/Investigator

2004 Project Reports

Five project reports are included at the end of the Annual Report.

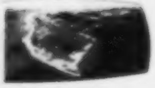
Lake Erie Basin Annual Report 2004/2005
Report by: R. Drouin
The annual Canada-Ontario Agreement report provides an update on activities taking place in the Lake Erie and Lake St. Clair basins. Since March, 2003, Lake Erie allocation of $2.8 million in funding has supported the implementation of 64 projects that not only contribute to cleaning up the Great Lakes and protect the province's unique coastal environment, but also leveraged nearly $7 million dollars in additional in-kind and financial contributions as a result of the almost 80 partnerships maintained or created across Lake Erie.

Winter Access Point Creel Survey 2004: Inner Long Point Bay, Lake Erie
Report by: E. Arnold
This report documents an access point creel survey that took place January-March, 2004. Two recent cold winters resulted in a strong ice fishery in Inner Long Point Bay. Yellow perch catches in 2004 were reported to be comparable to catches in the 2003 winter fishery, although anglers noted that the fishing was slightly better in 2003 due to catches of larger yellow perch.

Ontario Walleye Scale/Otolith Ageing Comparison
Report by: M. Belore, C. Marsh, C. McDonald, L. Laforet, B. Locke
This report documents a comparison of ages determined from scales and otoliths of walleye collected from various management units in Lake Erie. In total, 214 fish were aged and the data were used to make a recommendation regarding whether or not the Ontario Ministry of Natural Resources commercial catch sampling program requires walleye to be aged using otoliths or if the program should continue to age walleye using scales.

2004 Lake Whitefish Survey Summary
Report by: M. Belore and B. Locke
This report documents the size and age structure of the western basin lake whitefish spawning population. The report presents data on fish condition, gonadosomatic index, and a variety of measurements such as total and fork lengths, weight, sex, and maturity. Whitefish ranged in age from 4 to 20 years, with females tending to be older than males.

Lake Erie Central Basin Access Creel Survey, 2004
Report by: T. MacDougall, D. Greenwood, E. Arnold, B. Locke
This report documents the 2004 access point creel survey that was completed in partnership with the Ontario Federation of Anglers and Hunters. Angler interviews were conducted from June to August at Port Burwell, Port Bruce, Port Stanley, Port Glasgow, Erieau, and Wheatley. The survey data quantified the catch and harvest of target species, monitored angler effort and success rates, monitored age, length and diet of species harvested, and provided information about angler preferences in the central basin.



▶ PROTECTING BIODIVERSITY 3

▶ RESTORING FISH AND WILDLIFE 4

▶ ENHANCING KNOWLEDGED 5

ANNUAL REPORT

2004 / 205

Ontario

Lake Erie COA

"WORKING TOGETHR TO MAKE PROGRESS ON RESTORING THE ECOLOGICAL HEALTH OF THE GREAT LAKES BASIN"

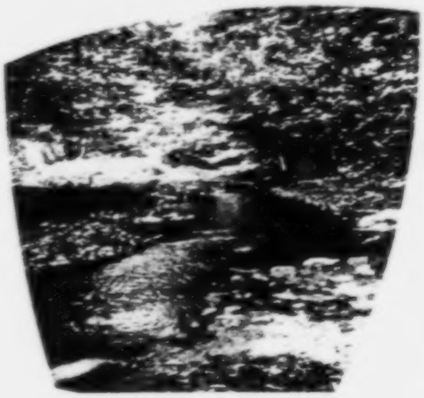
Canada and the U.S. are signatories to the Great Lakes Water Quality Agreement (2000-2005) and share responsibility for restoring and maintaining the chemical, physical and biological integrity of the waters of the Great Lakes Basin.

Message from the Chair

On behalf of the Lake Erie Management Committee and the Ministry of Natural Resources I would like to extend my sincerest thanks to all those dedicated to meeting Ontario's commitments to the Canada-Ontario Agreement.

Together, in 2004-2005. MNR staff worked with over 80 partners including volunteer groups, conservation authorities, schools, municipalities, industry and private landowners to develop, plan and implement close to 40 projects across the Lake Erie Basin. Their hard work and dedication has made significant contributions to a healthy, prosperous and sustainable Lake Erie Basin Ecosystem for present and future generations.

Michael J Morencie
Manager
Lake Erie Management Unit
Ministry of Natural Resources



Executive Summary

The Canada-Ontario Agreement outlines federal and provincial roles, responsibilities and commitments to implement the GLWQA, of which the Minister of Natural Resources shares the responsibility of leading or co-leading in 28 of the 181 commitments and has agreed to support the implementation of 23 other commitments.

The current 2002-2007 Canada-Agreement supports the public agenda of restoring the Great Lakes as well as maintaining healthy waters and habitats in the entire watershed basin of the Great Lakes through a commitment to work in a cooperative, coordinated and integrated fashion to achieve the COA vision.

In Lake Erie, the goal of COA is to support projects that contribute to improving the health of aquatic communities in Lake Erie and the St. Clair System. Efforts also focus on recovery of "downstream" waters, fish and wildlife habitat and their populations"

Since March of 2003, Lake Erie's allocation of $2.8 million in funding has supported the implementation of 64 projects that not only contribute to cleaning up the Great Lakes and protecting the province's unique coastal environment, but also helped to leverage nearly $7 million dollars in additional in-kind and financial contributions as a result of the almost 80 partnerships maintained or created across Lake Erie. It is through this dedicated funding that Lake Erie can support Ontario's efforts to:

- Protect Biodiversity;
- Restore Fish and Wildlife Habitat and Populations;
- Enhance our Understanding and knowledge about the Ecological Health of Lake Erie

Canada-Ontario Agreement
Respecting the Great Lakes Basin Ecosystem

"HEALTHY, PROSPEROUS, AND SUSTAINABLE GREAT LAKES BASIN ECOSYSTEM FOR PRESENT AND FUTURE GENERATIONS".

2004- 2005 Summary

The Great Lakes Water Quality Agreement was amended in 1987 to include under Annex 2, the development of Remedial Action Plans and Lake Wide Management Plans.

Areas of Concern

The Ministry of Natural Resources is working with our partners to implement remedial actions across four Canadian Lake Erie "hotspots" known as Areas of Concern. These Areas of Concern represent locations where significant alterations to the chemical, physical or biological integrity have impaired one or more of the 14 assessed beneficial uses.

Result 3: Reduced nutrient, microbial and trace contaminants from agriculture sources

Result 5: Rehabilitate aquatic and riparian habitat leading to the re-establishment of fish and wildlife populations

- $172 thousand to support four private land stewardship initiatives; providing landowners with technical and financial assistance to develop and implement best management practices and habitat restoration projects in the Detroit River, St Clair River, Wheatley Harbour and Niagara River Areas of Concern

Result 7: Publicly available environmental monitoring information to make informed decisions in Areas of Concern

- $180,000 to undertake Fish Community Assessment studies in the Detroit River, St Clair River, Wheatley Harbour and Niagara River Areas of Concern

Lake Erie Lakewide Management Plans

Lake Erie Lakewide Management is a comprehensive plan designed to preserve, restore and protect the beneficial uses of Lake Erie. Guided by the vision of maintaining a healthy sustainable Lake Erie ecosystem, Natural Recourses' staff and partners are working together to restore and to protect the natural habitat, to reduce nutrient loadings, to eliminate contamination, and to prevent the introduction of invasive species.

Result 2: Rehabilitate, conserve, and protect fish and wildlife habitats and protected areas

- $248,000 to maintain healthy Lake Erie watersheds by supporting seven private land stewardship initiatives; providing landowners with technical and financial assistance to develop and implement best management practices and habitat restoration projects
- $47.6 thousand to protect aquatic species at risk
- $206,000 to protect, conserve and restore wetland habitat across the Lake Erie basin
- $5 thousand to assess barriers to fish movement on the Thames and Grand Rivers and to prioritize efforts for barrier removal
- $362,000 to support restoration strategies by enhancing our knowledge of the causes of ecological impairment to fish community structure and their aquatic habitat.

Result 6: Improved scientific understanding of the fate and effects of harmful pollutants and causes of ecological impairment for each lake

- Supported the Lake Erie LaMP Collaborative Monitoring ($40,000)
- Initiated one research project on invasive dreissenid species ($20,000)

Result 5: Collaboration between government, organizations and basin residents

- Supported 81 Partnerships
- Total Project Value: $5.3 million (Partner contributions + COA)
- Government Contributions: $3.8 million
  - In-Kind Contributions: $2.4 million
  - Financial Contribution: $ 1.5 million
- Non Government Contribution: $2.4 million
  - In-Kind Contributions: $1.4 million
  - Financial Contribution: $0.9 million

GOALS & PRIORITIES:

Annex 1 - Areas of Concern

1) **Completing all required actions for Remedial Action Plans for Wheatley Harbour**
2) **Making Progress toward rehabilitation of ecological systems in;**
   - **St Clair River AOC**
   - **Detroit River AOC**
   - **Niagara River AOC**

Annex 3 – Lakewide Management Plans

1) **Clearly understanding the environmental problems and causes of ecological impairment**
2) **Reaching consensus on and having broad based support for direction and priority actions for environmental restoration, protection and conservation**
3) **Making progress on habitat restoration, conservation and protection and reducing the harmful pollutants with a lake-by-lake focus**

Within the priority watersheds of;
- **Thames River**
- **Grand River**
- **Rondeau Bay**

As well as support efforts in maintaining healthy waters and habitats in the entire watershed of Lake Erie

Protecting Biodiversity

Species at Risk

In the Lake Erie Basin the Ministry of Natural Resources is taking the lead role in protecting Ontario's biodiversity by monitoring and assessing the status of aquatic species at risk, ensuring that essential knowledge is available to support the development of recovery plans and to make informed decisions about the protection and rehabilitation of species at risk habitat.

Lake Erie Watersnake

The Lake Erie Watersnake is an endangered species found only in the Lake Erie Archipelago.

On-going mark-recapture techniques using Passive Integrated Transponders (PITs) on East Sister and Middle Islands is being used to estimate population size and life history patterns in support of a Lake Erie Water Snake Recovery Plan.

Recovery Team experts recommend expanding the Lake Erie Watersnake population study to Pelee Island in hopes of addressing population estimate gaps for the Archipelago. Using COA dollars researchers were able to expand the Lake Erie Watersnake study to include the more than 35 km of Pelee Island shoreline.

Results

- Developed and implemented a protocol for population surveys on Pelee Island
- Established 11 survey sites
- Completed 40 Visual line transect work and 4 searches
- Recorded 163 observations
- Tagged 63 watersnakes
- Completed a summary report

Wetlands

Protecting, conserving and restoring wetlands is a priority in the Lake Erie Basin and the Ministry of Natural Resources is taking action to implement the Great Lakes Wetland Conservation Action Plan including the securement, restoration, evaluation, and inventory and monitoring of wetlands from coastal marshes to inland swamps.

Lower Big Creek Restoration

The Huyge Property is a 34 hectare Carolinian forest/wetland complex with agricultural land located within the lower reaches of the Big Creek watershed. The property is situated within Lower Big Creek Provincially Significant Wetland, adjacent to a Regionally Significant salmonid migration route, and upstream of the Long Point Inner Bay Wetland Complex and RAMSAR site. Waterfowl surveys indicate that the area serves as valuable waterfowl staging area for spring and fall migrants. The property and adjacent lands are also home to a number of species at risk and are considered a priority area under the Carolinian Canada "Big Picture" initiative, serving as a linking corridor to several core areas including the Deer Creek/Hepburn Forest, the South Willingham Sand Ridges Forest and Big Creek Floodplain Forest.

ACTIONS & ACHIEVEMENTS:

Lake Erie Watersnake Pelee Island

Allocation: $375,500
Projects: 12

- ○ **Study habitat use and movement by the eastern spiny softshell turtle in Rondeau Bay using radio-telemetry.**
- ○ **Inventory and assessment of Fowlers Toad and to investigate habitat use along the Lake Erie shoreline.**
- ○ **To estimate Lake Erie water snake population and to determine habitat use on Pelee Island.**
- ○ **To support the development and implementation of the Essex Region SAR recovery plan.**
- ○ **To assess river and black redhorse at the Dunnville Dam during spring spawning migration on the Grand River.**

Huyge Property Wetland Acquisition

- ○ **Restore the lower Big Creek floodplain**
- ○ **Support wetland restoration activities of the Wetland Drain Restoration project in key areas of the Lake Erie basin.**
- ○ **Conduct wetland evaluations in the Lake Erie basin to prioritize significant wetlands for protection and restoration.**
- ○ **Conduct engineering studies toward restoration of Grand River wetlands near Dunnville.**

Fish and Wildlife Populations & Habitat Resoration

Protect, Conserve, & Restore Fish & Wildlife Habitat

By working through the Stewardship Network and our Partners to help provide technical support and financial assistance to landowners, volunteer organizations and stakeholders to rehabilitate aquatic and riparian habitat, the Ministry of Natural Resources is making a significant contribution to addressing the continuing sources of non-point pollution to our Areas of Concern and to priority watersheds identified by Lake Erie LaMP.

Niagara River AOC Natural Heritage

Land Care Niagara is part of the Ontario Ministry of Natural Resources Stewardship Program, a southern Ontario network of 40 councils consisting of landowners, land interest groups and stakeholders who determine what the environmental priorities are for a their given area in Ontario.

In 1997, Land Care Niagara in partnership with Ontario Hydro initiated a Natural Heritage Ecological Framework for the Niagara Region. The purpose of the ecological framework is to:

- Identify natural heritage features
- Maximize the benefits of a coordinated effort
- Prioritize the conservation, protection and restoration of natural heritage resources

In 2000, Land Care Niagara and its partners implemented a restoration strategy that is consistent with the goals and objectives established by the Natural Heritage Ecological Framework.

By supporting the Natural Heritage Ecological Framework and Land Care Niagara, private landowners are receiving technical and financial assistance to implement best management practices, restore habitat and to reduce non-point source loadings to Lake Erie and the Niagara River AOC.

Results to date

- Planted more than 90,000 native trees and shrubs
- Restored 82 ha of habitat
- Established 5880m of buffer / riparian habitat

Population Monitoring and Habitat Assessment

The Ministry is also working with a number of federal and provincial agencies, and conservation authorities to monitor the status of fish populations and to report on habitat conditions across a number of watersheds. The goal is to ensure that essential knowledge is made available to make informed decisions about future habitat protection and restoration actions required to reduce ecological impairments to Lake Erie.

Rondeau Bay Fish Assessment

Rondeau Bay's marshes are a provincially significant coastal wetland and an Environmentally Sensitive Area which play a vital role in sustaining populations of common and rare species of birds, mammals, amphibians and fish. The marshes themselves provide excellent spawning, nursery and feeding habitats for several sport, forage and bait fish making the area popular for recreational fishing opportunities. In 2004, with the assistance of COA funds, the Lake Erie Management Unit and the Department of Fisheries and Oceans partnered to undertake an assessment of the fish community in Rondeau Bay. The objectives of the survey included a comprehensive survey of fish community, a gear comparison study and an evaluation of Fish Species at risk within the littoral habitat of Rondeau Bay.

Results

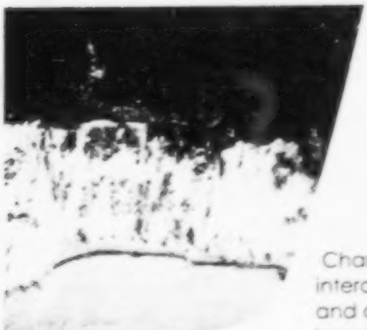
- Boat electro-fished 16, 300m transects
- Habitat data collected at each site
- Determined Species Richness scores
- Hoopnet sampling at each transect
- 1011 fish caught
- Identified 10 unique species including spotted gar

ACTIONS & ACHIEVEMENTS:

Allocation: $963,000
Projects: 23

- ○ Conduct landowner-based habitat stewardship and Best Management Strategies to reduce nutrient and sediment loading in priority watersheds and Areas of Concern
- ○ Support barrier assessment, prioritization and removal activities in the Thames River and Grand River watersheds.
- ○ Support sub-watershed restoration projects aimed at restoring habitat, barrier removal, monitoring, and outreach on Thames River tributaries
- ○ Support the development and implementation of the Lynn River watershed restoration

- ○ Support activities of the Grand River Migratory Fish working group.
- ○ Conduct water quality, habitat and benthic sampling in the Thames River and Grand River.
- ○ Inventory and assessment of Lake Erie lake herring population.
- ○ Inventory and assessment of the fish community in the priority watersheds and Areas of Concern



Enhancing our Knowledge of the Ecological Health of Lake Erie

Monitoring and Research

Characterized by it shallow, productive waters and dynamic interactions, Lake Erie is subject to short turn-around periods and continuous change. An important first step towards improving our understanding of the fate and effects of contaminants and other causes of ecological impairment in Lake Erie can be achieved through improved basin wide collaboration and research. In 2004-2005, MNR Lake Erie Basin COA supported monitoring and research efforts designed to increase our knowledge and awareness of the impacts, distribution and disruption to food-web dynamics of the invasive zebra mussels.

Lake Erie Collaborative Monitoring

In the fall of 2001, the Bi-national Executive Committee identified the need for improved coordination of monitoring in the Great Lakes, resulting in the development and implementation of a bi-national, basin-wide inventory and monitoring of the Great Lakes. This cooperative monitoring approach focuses on coordinating monitoring needs for only a few key information gaps, one lake at a time, with an emphasis on data sharing, information exchange and technology transfer among agencies and researchers.

Information gaps identified for Lake Erie LaMP 2004 Collaborative Monitoring emphasized the need for a current estimate of lake-wide distribution and abundance of dreissenid mussels across Lake Erie in order to determine the impacts of energy flow, changes to food-web dynamics, and contaminant impacts as a result of the dreissenid-dominated benthos.

This study will be the first lakewide, comprehensive survey of dreissenid and benthic invertebrate distribution, abundance and biomass in Lake Erie.

Results to Date

- Partnership created among 11 Canadian and US academic/government institutions
- Total of 10 vessels (2 OMNR) visited 283 locations across Lake Erie collecting sediment, water chemistry and benthos
- Analyzed benthic invertebrate composition, sediment properties, chemical contamination and epipelic algae
- Reported preliminary findings at the 48th Annual Conference of the International Association for the Great Lakes

DID YOU KNOW…

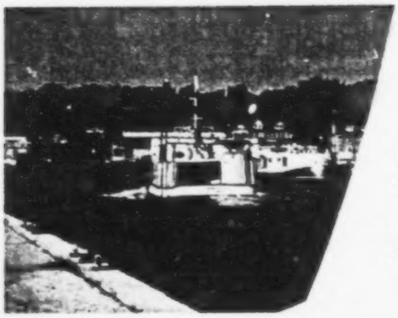
Lake Erie is the smallest by volume, shallowest, and most biologically productive of the Great Lakes. Lake Erie is naturally divided into three basins that differ in their physical, biological, and chemical characteristics. The western basin is shallow, with an average depth of only 7.4 m, the central basin is moderate, with an average depth of 18.3 m, and the eastern basin is deepest, with an average depth of 25 m. Eighty percent of Lake Erie's inflow of water comes from the Detroit River, 11% is from precipitation, and the remaining 9% comes from tributaries flowing directly into the lake. The Niagara River is the main outflow. There are 34 sub-watersheds within the Lake Erie basin many of which have unique features and stresses

About one-third of the total population of the Great Lakes basin resides within the Lake Erie watershed. Almost 12 million people reside in the Lake Erie basin, including 17 metropolitan areas with populations of more than 50,000 people. Of all the Great Lakes, Lake Erie is exposed to the greatest stress from urbanization, industrialization, and agriculture. It surpasses all the other Great Lakes in the amount of effluent received from sewage treatment plants and is most subjected to sediment loading

ACTIONS & ACHIEVEMENTS:

Allocation:	**60,000.00**
Projects:	**2**

- **To support LaMP research and monitoring priorities on Lake Erie (e.g., food web alterations, impacts of invasive species) by supporting the Ministry of Natural Resource's contribution to the Lake Erie LaMP Collaborative Monitoring.**
- **To study dreissenid production, impact of dreissenid pseudo-faeces, presence/absence of round gobies, and implications to recent severe botulism events.**



Financial Statement

MNR, through its COA dedicated funding, can support Ontario's efforts to protect biodiversity, restore fish and wildlife beneficial uses, and gain new understanding and knowledge about the ecological health in the Great Lakes ecosystem

Project Name and Initiative	Initial Allocation	Transfer	Final Allocation
COA Coordinator	85.0		85.0
Lake Erie Basin IM & Communication	10.0	(10.0)	0.0
Essex Region SAR Recovery Plan	10.0		10.0
Total Planning & Coordination	105.0	(10.0)	95.0
Thames River Fish Community Monitoring	77.0		77.0
Sydenham River Walleye Tagging	NF		NF
Rondeau Bay Fish Community Assessment	10.0	10.0	20.0
Detroit/St Clair River AOC Fish Community Inventory and Assessment	51.0		51.0
Lake Erie Coregonid Assessment Program	37.0		37.0
Lake Erie Smelt Bycatch Study	25.0	(20.0)	5.0
Lake Erie LaMP Collaborative Monitoring of Nearshore Areas	30.0	10.0	40.0
Thames River Habitat Assessment and Monitoring	35.0		35.0
Rondeau Bay Eastern Spiny Softshell Radio Telemetry	5.0		5.0
Lake Erie Watersnake	7.5		7.5
Wetland Evaluations – Aylmer District	27.0		27.0
Distribution, Abundance & Habitat Use by Fowlers Toad – Lake Erie North Shore	25.0		25.0
Niagara River AOC Lyon's Creek Watershed Study	25.0	(25.0)	0.0
Niagara River AOC Fisheries Assessment	125.0		125.0
Wetland Evaluations – Guelph District	27.0		27.0
Total – Inventory, Monitoring and Assessment	506.5	(25.0)	481.5
Wheatley Harbour AOC	55.0	(13.0)	47.0
Thames River Demonstration Sub-Watershed	25.0		25.0
Thames River Watershed Barrier Assessment	2.5		2.5
Grand River Multi-Partner Initiative	191.0		191.0
Lynn River	15.0		15.0
Norfolk Habitat Restoration Initiative	35.0		35.0
Thames River Stewardship Initiative	35.0	8.0	43.0
St Clair River AOC Stewardship Initiative	35.0		35.0
Detroit River Stewardship	35.0		35.0
Rondeau Bay Habitat Stewardship Initiative	35.0		35.0
Lower Big Creek Restoration Project	20.0	64.0	84.0
Niagara River AOC – Drapers Creek Barrier Removal	20.0		20.0
Grand River Dam Review Committee	2.5		2.5
Grand River Stewardship Initiative	55.0	20.0	75.0
Grand River Migratory Fish Committee Support	2.5		2.5
Expansion of LOOP Program in Trout Creek	10.0	(10.0)	0.0
Niagara River AOC Natural Heritage Linkages	35.0	15.0	50.0
Total – Management of Fish & Wildlife Habitat	608.5	84.0	697.5
Dreissenid Mussel Dynamics	20.0		20.0
Total - Research	20.0		20.0
Rehabilitation & Creation of Grand River Wetlands	40.0		40.0
Wetland Drain Restoration Project	90.0	10.0	100.0
Canard River Wetland – General Chemical Property	10.0		10.0
Lake St Clair – Dover Heritage Wetland Project	40.0	(12.0)	28.0
Sydenham River / St Clair River Stewardship Initiative	20.0		20.0
Calton Swamp Acquisition		12.0	12.0
Total Wetlands	200.0	10.0	210.0
TOTAL ALLOCATIONS	1440	64.0	1504
Expenditures			
Planning & Coordination			92.9
Inventory, Monitoring & Assessment			580.8
Management of Fish & Wildlife Habitat			673.3
Research			1.3
Wetlands			125.7
TOTAL EXPENDITURES			**1473.6**

GUIDING PRINCIPLES & LINKAGES:

The scale and diversity of challenges facing the Great Lakes environment requires a commitment to a delivery model based on collaboration, stewardship and partnership.

Emphasis will be on-the-ground actions

Collaboration, stewardship and partnerships

Leveraging partner funding

Allocations to be linked to COA results and MNR objectives

- **Area of Concern work plan**
- **Lake Erie LaMP**

- **Fish Community Goals and Objectives**
- **North American Waterfowl Management Plan**
- **Wetlands & Great Lakes Wetlands Conservation Action Plan**
- **Aquatic Species at Risk & Fish Biodiversity**
- **Research and Invasive Species**

Lake Erie Fisheries Assessment Unit Report 2004

Winter Access Point Creel Survey 2004
Inner Long Point Bay, Lake Erie

E. Arnold

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Table of Contents

Introduction 5

Methods 5

Results 6
Biological Data 6
Effort Estimates 6
Yellow Perch Estimates 6
Northern Pike Estimates 7
Mudpuppy Estimates 8
Angler Profile 8
Other Species 8

Discussion 8
Historical Perspective 9

References 10

List of Figures

Figure 1. Map of the Long Point Inner Bay and surveyed areas 11
Figure 2. Mean age (yrs) and length (mm) for yellow perch sampled from four areas in Inner Long Point Bay during the 2004 ice-fishing season 12
Figure 3. Numbers of yellow perch caught, harvested, and released from three areas in Inner Long Point Bay during the winter creel survey 13
Figure 4. The proportion of the total catch of yellow perch caught during weekdays and weekends 13
Figure 5. The proportion of the total harvest of yellow perch caught during weekdays and weekends 14
Figure 6. Catch per unit effort for yellow perch caught in three areas in Inner Long Point Bay during the winter creel survey, reported in angler and rod hours 14
Figure 7. Numbers of northern pike caught, harvested, and released from three areas in Inner Long Point Bay during the winter creel survey 15
Figure 8. The proportion of the total catch of northern pike caught during weekdays and weekends 15
Figure 9. The proportion of the total harvest of northern pike caught during weekdays and weekends 16
Figure 10. Catch per unit effort for northern pike caught in three areas in Inner Long Point Bay during the winter creel survey, reported in angler and rod hours 16
Figure 11. Numbers of mudpuppy caught, harvested, and released from three areas in Inner Long Point Bay during the winter creel survey 17
Figure 12. The proportion of the total catch of mudpuppy caught during weekdays and weekends 17
Figure 13. The proportion of the total harvest of mudpuppy caught during weekdays and weekends 18
Figure 14. Catch per unit effort for mudpuppy caught in three areas in Inner Long Point Bay during the winter creel survey, reported in angler and rod hours 18

List of Tables

Table 1. Catch, harvest, and CUE estimates for yellow perch, northern pike, and mudpuppies from winter ice-fishing surveys in Long Point Inner Bay 19

Table 2. Mean length (mm), mean weight (g), and mean age (years) of yellow perch sampled during winter ice-fishing surveys in Long Point Inner Bay 20

Table 3. Historical and present-day residency status of angling parties in the Inner Long Point Bay winter ice-fishery 20

Introduction

Inner Long Point Bay is situated on the north shore of the eastern basin of Lake Erie (Figure 1), and is separated from the rest of Lake Erie by the Long Point peninsula. An access point winter creel survey took place in this area from January to March of 2004. It was the first of its kind since 1988. Prior to 1988, surveys were conducted on a regular basis, as far back as 1962, with the first taking place in 1959 (Timmerman 1988, Sztramko and Paine 1982). A limited amount of information exists for the earlier surveys, but those conducted in 1978, 1979, 1980, 1984, 1985, and 1986 were based out of St. Williams, and those conducted in 1982 and 1988 were based out of St. Williams and Port Rowan (no survey was done in 1981, 1983, and 1987; see Timmerman 1988 for details pertaining to the surveys conducted from 1978-1988). These surveys produced total harvest and effort estimates for the yellow perch fishery in that area.

The amount of ice fishing that takes place from year to year is correlated with the amount and duration of ice coverage. The commercial ice hut operators wait until there are 8-10 inches of ice before setting out huts (personal communications). For the past two seasons, the bay froze completely, which has allowed for an increase in fishing activity.

This report will provide results from a survey of the winter fishery in 2004.

Methods

A winter access point creel survey was conducted in the Inner Long Point Bay region of the Eastern Basin of Lake Erie from January 19 to March 3, 2004. The survey monitored ice fishing activity out of three main access points in Long Point Inner Bay; 1. St. Williams, 2. Shady Akers, and 3. Old Cut (Figure 1). The survey also monitored these three areas for catch/harvest of targeted species such as yellow perch (*Perca flavescens*) and northern pike (*Esox Lucieus*) (and mudpuppies, *Necturus maculosus*, as by-catch in February, as well as any other incidentals).

Vehicle counts were conducted at all access points, five to seven days a week from approximately 1000 to 1200. All vehicles parked along the road leading into the access points, in parking lots of the access points, and on the ice close to shore were included in the activity estimates. Staff attempted to include counts of all vehicles parked on the ice as well, but they found that they could not collect consistent dependable counts due to their inability to go out on the ice (staff not trained), and visibility problems (due to weather or hut distance from shore). Ultimately, the activity estimates will not include those vehicles that were not parked near or at the shore. All activity data was recorded on MNR Vehicle Count Forms.

Two to five days a week, staff conducted interviews in all three areas during peak hours (1200-1600). Staff only interviewed fishermen who were finished fishing for the day. They recorded data such as numbers of fish caught and released per party, length of time spent fishing, number of anglers, and number of lines, and number of vehicles in the party on Creel Interview Forms.

Biological samples were only collected from yellow perch (total length, fork length, and scale samples for aging purposes) before they were filleted at a local processing plant, or from yellow perch that were seized by conservation officers (and processed in the LEMU, Port Dover lab). All samples were taken from fish that were caught in St. Williams (n=61 plus an additional 197 fish that were seized), Shady Akers (n=162), Old Cut (n=108), and Long Point Provincial Park (71). Group weights of yellow perch were also obtained from the filleting station on three occasions.

Data were entered using Ministry of Natural Resources software, FISHNET Version 2 (Lester et al. 1989), and analyzed using formulas from Lester and Korver (1996).

Results

Biological Data

The yellow perch caught in St. Williams had an average total length of 173.8 mm, and an average age of 3.6 years. These were on average the smallest and youngest yellow perch caught during this survey.

The yellow perch caught in Shady Akers had an average total length of 215.6 mm, and an average age of 4.1 years. The yellow perch caught in Old Cut were slightly larger with an average total length of 218.9 mm, and an average age of 4.1 years. The yellow perch caught at Long Point Provincial Park had an average total length of 201.4 mm, and had an average age of 3.7 years. When all sites were combined the average total length was 196.5 mm, and the average age was 3.8 years (see Figure 2 for a summary of the above statistics).

Although Port Rowan was a site of regular fishing activity, samples were not obtained from this area so we are unable to report statistics on yellow perch. Although, based on the above observations we can assume numbers would be similar to those reported at all other sites.

One interesting thing to note about the St. Williams' estimate is that when the seized fish were removed from the calculations the average total length increases to 213.8 mm and the average age increases to 4.1 years. The differences between the two groups of data are substantial and may be explained by the fact that the fishermen responsible for the seized fish (two people fishing together on one day) were keeping everything they caught (big and small fish) while most fishermen only keep larger fish. With this in mind, the combined estimates reported for St. Williams would be biased. Seized fish were not included in harvest estimation calculations.

Effort Estimates

Anglers fished 59,071 angler hours (72,963 rod hours) in St. Williams, 31,279 angler hours (34,398 rod-hours) in Old Cut, and 29,521 angler hours (37,154 rod hours) in Shady Akers. The amount of angler hours compared to rod hours is very similar, which indicates that most anglers were only fishing with one rod.

Yellow Perch Estimates

Yellow perch harvest, release, catch, and CUE estimates were calculated for St. Williams, Shady Akers and Old Cut.

Fishing success was highest in Shady Akers, followed by St. Williams and Old Cut. Anglers averaged 5.6 fish/angling-hour (4.5 fish/rod-hour) in Shady Akers, 4.9 fish/angling-hour (3.9 fish/rod-hour) in St. Williams, and about half that in Old Cut (2.6 fish/angling-hour and 2.4 fish/rod-hour; Figure 6). This lower level of fishing success may explain why Old Cut had the lowest catch and harvest rates.

There were an estimated 288,008 yellow perch caught out of St. Williams during the survey (44% of which were harvested from the lake), 165,680 caught out of Shady Akers (47% harvested), and 81,710 caught out of Old Cut (40% harvested; Figure 3). When all sites were combined, a total of 535,399 yellow perch were caught during the survey, and 236,051 were harvested.

The fishery was evenly split between weekends and weekdays in all areas. Fifty-four percent of the yellow perch caught in St. Williams were caught on weekdays. Weekday catches made up 51% and 55% of the total catch in Shady Akers and Old Cut respectively (Figure 4).

The harvest data showed a slightly different trend. More fish were harvested out of St. Williams and Old Cut on weekdays compared to weekends (St. Williams-59% on weekdays, 41% on weekends, and Old Cut- 62% on weekdays, 38% on weekends). There were about equal amounts of yellow perch harvested in Shady Akers between the two day types(49% on weekdays compared to 51% on weekends; Figure 5).

Harvested biomass was estimated using a mean weight calculated from groups weights collected from the processing plant. A total of 251 yellow perch had a mean weight of 125.05 g, which translates into a total estimated harvested weight of 29,518 kg (65,076 lbs). For comparison purposes, last year (2003) the hoop and seine commercial fishery in Inner Long Point Bay harvested 10,650 kg (23,480 lbs) of yellow perch (Lake Erie Management Unit, Port Dover, Ontario, N0A 1N0, unpublished data). This means the winter sport fishery is harvesting 2.8 times the amount of yellow perch in the Inner Bay compared to the commercial fishery. This observation will be important for future management decisions.

Northern Pike Estimates

An estimated 385 northern pike were caught incidental to yellow perch, and 295 of those were harvested. Fifty percent of the total catch was caught in Old Cut, 36 % in St. Williams and 14 % in Shady Akers (Figure 7). Fifty-six percent of the total harvest were harvested out of Old Cut, 44 % were harvested out of St. Williams, and none were recorded at Shady Akers.

A disproportional amount of northern pike were caught on the weekends compared to weekdays in each area (Figure 8). In St. Williams and Old Cut (these two sites contributed 86 % of the total catch), approximately 85 % of the catch was caught on the weekend. In Shady Akers all of the northern pike caught were caught on weekdays (55 fish). Sixty-four percent of the pike harvested in St. Williams were harvested on the weekend and 83 % were harvested from Old Cut on the weekend (Figure 9).

Figure 10 shows that the highest CUE for northern pike was found in Shady Akers, where anglers were catching 0.04 fish/angler (and rod) hour. Catch rates were approximately four times higher at this location than at either of the other two areas.

Mudpuppy Estimates

Mudpuppy catch was not monitored during past winter creel surveys. In 2004, 2,484 mudpuppies were caught and 133 were harvested or left on the ice. Catch was highest in Old Cut, followed by St. Williams and Shady Akers (Figure 11). All mudpuppies caught in St. Williams and Shady Akers were released back into the lake. Approximately ten percent of mudpuppies caught in Old Cut were harvested instead of released.

There are no differences observed between the three areas as far as day of the week effect (Figure 12). Day of the week did not seem to have an effect in St. Williams, as there were approximately an equal number caught on weekdays compared to weekends. The amount of mudpuppies caught on weekends decreased to 24.1 % in Shady Akers, and increased to 94.9 % in Old Cut. Harvest distribution by day type is much less interesting because mudpuppies were only harvested in Old Cut, and 100 % of those were removed on the weekend (Figure 13).

The highest catch rates were observed in Old Cut (Figure 14). The average angler caught 0.062 mudpuppies per angler hour and 0.056 mudpuppies per rod hour. Catch rates were almost identical in St. Williams and Shady Akers (approximately 0.02 mudpuppies/angler hour and 0.01 mudpuppies/rod hour).

Angler Profile

Ontario residents made up 99.8 % of the angling parties that fished during the winter survey. Of that percentage, 63 % were local (Tillsonburg, Delhi, Simcoe, Port Rowan, Port Dover, etc.) and 37 % were from outside the immediate area (i.e. Hamilton, Brantford, Woodstock, St. Thomas, Windsor, etc.). The remaining 0.2 % were angling parties that originated from the United States (Table 3).

Other Species

The only other incidental species that were caught during this survey were largemouth bass and white perch. Both species were only observed two times throughout the duration of the survey.

Discussion

Two recent cold winters resulted in a strong ice fishery in Inner Long Point Bay, creating a renewed interest in monitoring. The yellow perch fishery in that area has been exploited by both sport and commercial fishermen for years, and fishing goes on year around (commercial fishing in the spring and fall, sport fishing in the summer and winter). For this reason it has become important to quantify the effect the winter sport fishery has on the overall resource in that area.

Yellow perch catches in 2004 have been reported to be comparable to that of the 2003 winter fishery (personal communications), although anglers have commented that the fishing was slightly better last year due to catches of larger yellow perch. Previous to 2003, winter conditions were variable. This variability resulted in years of limited to no fishing at all in the Inner Bay.

Historical Perspective

Estimates of catch for 2004 are comparable to estimates from the early 1980's (Table 1), but harvest estimates are quite different. In the early 80's, 60-73 % of the catch was harvested, but only 44 % of the catch was harvested in 2004. This difference can not be explained by size of fish because fish were on average smaller back then if based on weight estimates, or approximately the same size if based on length estimates (Table 2). Alternatively though, the difference may be explained by the fact that there were no harvest limits for yellow perch in the 80's (compared to the present day harvest limit of 50 fish/day), and catch rates were usually higher during that time.

The yellow perch CUE estimate from 1980 was very high (8.72 fish/rod-hr), but decreased to 5.36 fish/rod-hr in 1982 and 3.78 fish/rod-hr in 1984. CUE estimates continued to decline through to 1988. The catch rate estimate in 2004 was similar to that of 1984.

Catch and harvest estimates for northern pike in 2004 are also similar to estimates produced in the 1980's, but the 2004 catch rate is lower now than it was then (Table 1). One interesting thing to note is that all pike caught were typically harvested in the late 70's and 80's, but in years such as 1980 and 2004 that was not the case. This is difficult to explain, but it is possible that in years of good perch fishing, anglers were not as interested in keeping pike even when catch rates were high.

The significance of the mudpuppy harvest is unknown. We are unable to determine how the fishery may have impacted the population in the Inner Bay. This species is part of the lower trophic level in Lake Erie and feed primarily on crayfish, although also consume such things as insects, fish, worms, and snails (University of Michigan Museum of Zoology, 2004).

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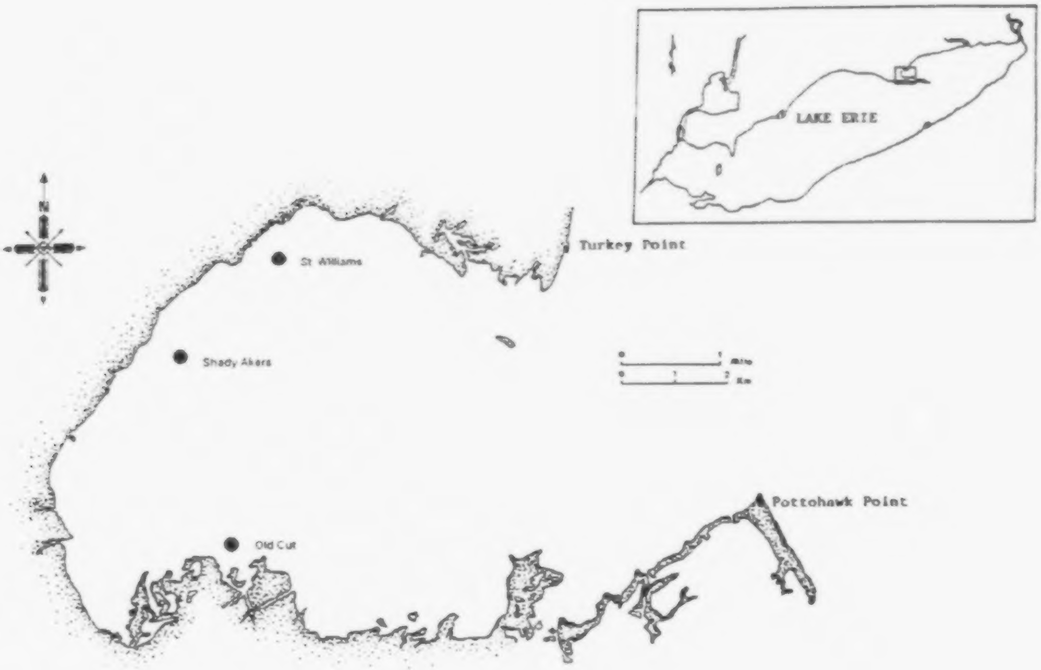
LAKE ERIE
N
St Williams
Turkey Point
Shady Akers
0
1
0
1
2
Old Cut
Pottohawk Point

Figure 1. Map of the Long Point Inner Bay and surveyed areas.

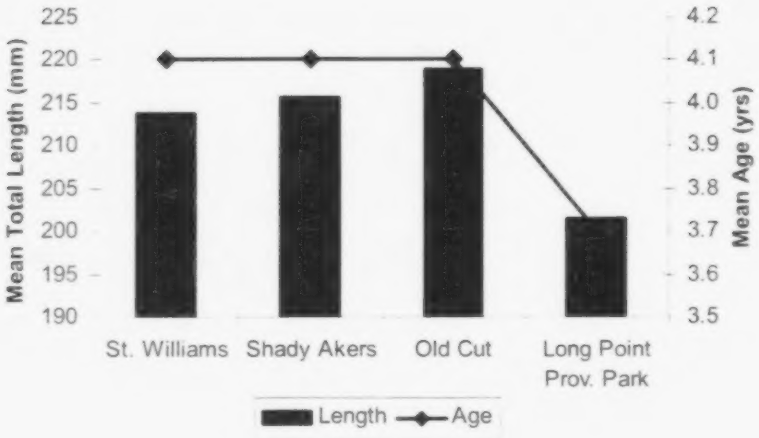

Figure 2. Mean age (yrs) and length (mm) for yellow perch sampled from four areas in Inner Long Point Bay during the 2004 ice-fishing season.

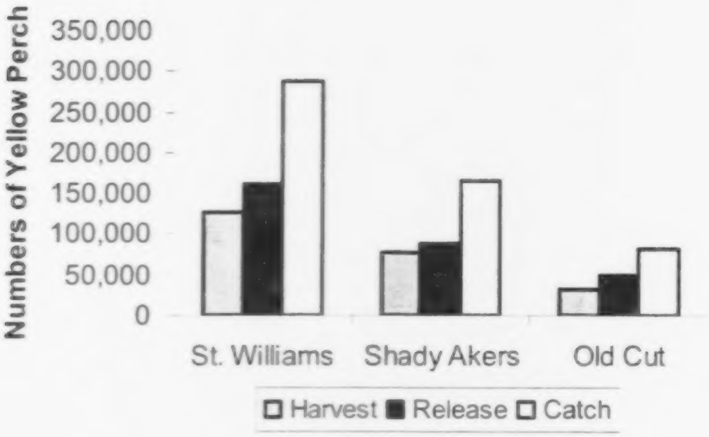

Figure 3. Numbers of yellow perch caught, harvested, and released from three areas in Inner Long Point Bay during the winter creel survey.

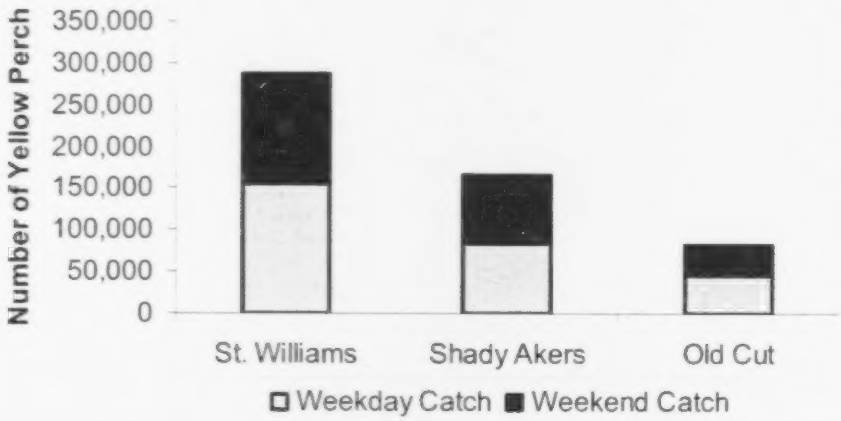

Figure 4. The proportion of the total catch of yellow perch caught during weekdays and weekends.

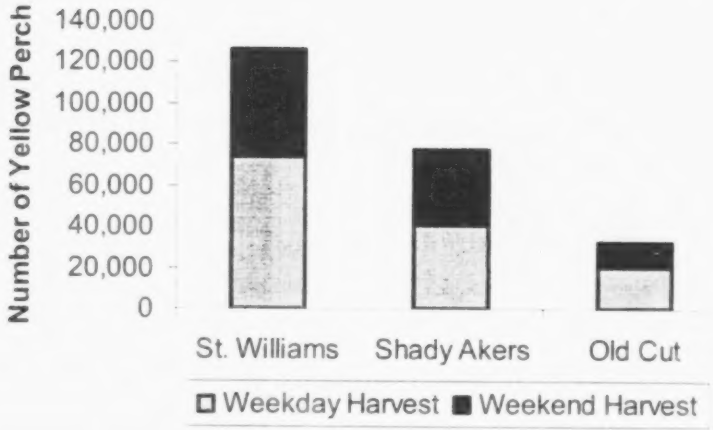

Figure 5. The proportion of the total harvest of yellow perch caught during weekdays and weekends.

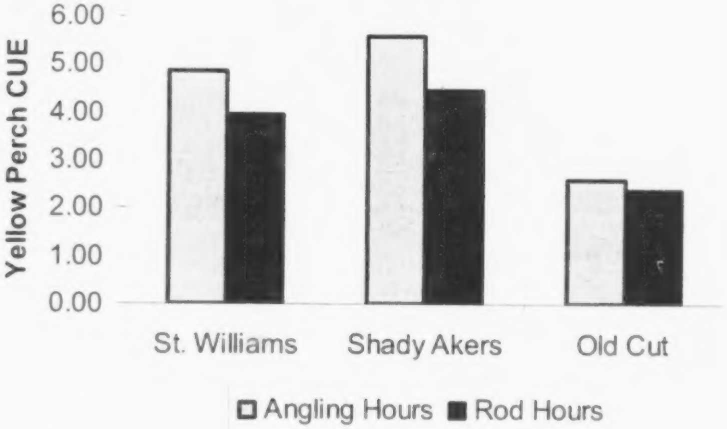

Figure 6. Catch per unit effort for yellow perch caught in three areas in Inner Long Point Bay during the winter creel survey, reported in angler and rod hours.

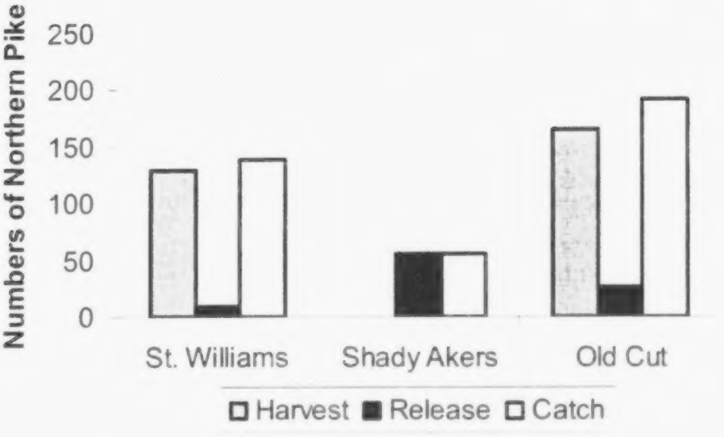

Figure 7. Numbers of northern pike caught, harvested, and released from three areas in Inner Long Point Bay during the winter creel survey.

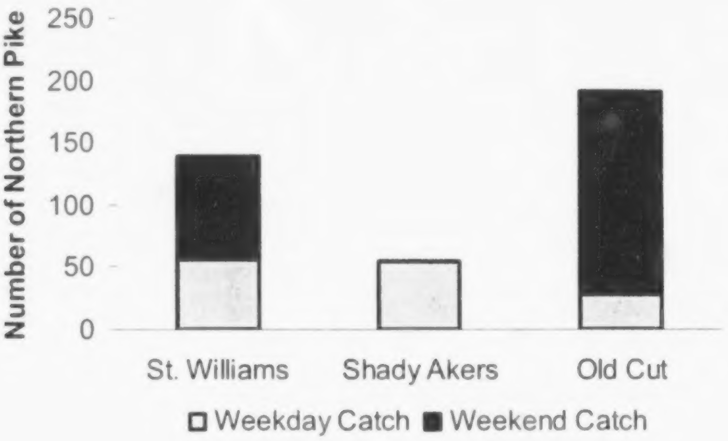

Figure 8. The proportion of the total catch of northern pike caught during weekdays and weekends.

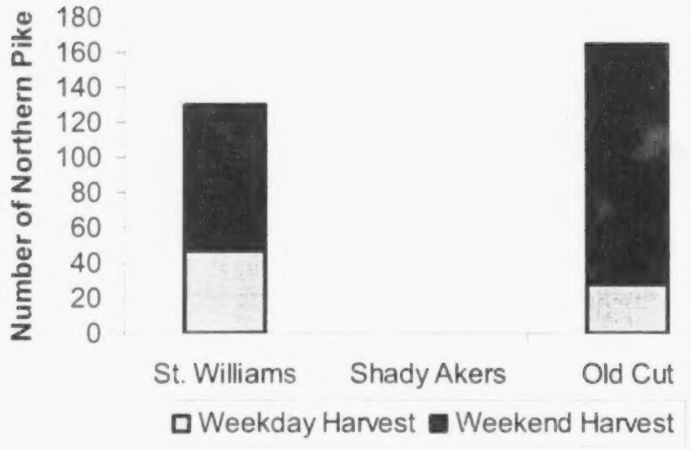

Figure 9. The proportion of the total harvest of northern pike caught during weekdays and weekends.

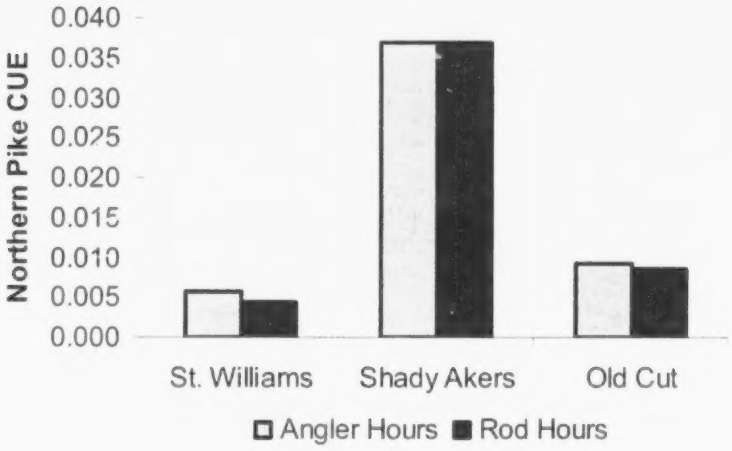

Figure 10. Catch per unit effort for northern pike caught in three areas in Inner Long Point Bay during the winter creel survey, reported in angler and rod hours.

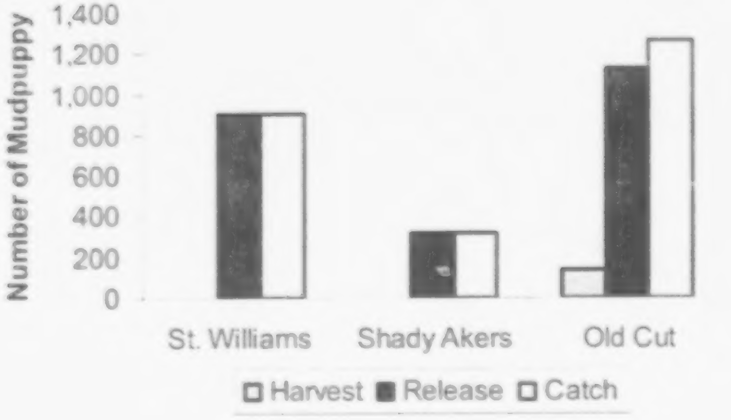

Figure 11. Numbers of mudpuppy caught, harvested, and released from three areas in Inner Long Point Bay during the winter creel survey.

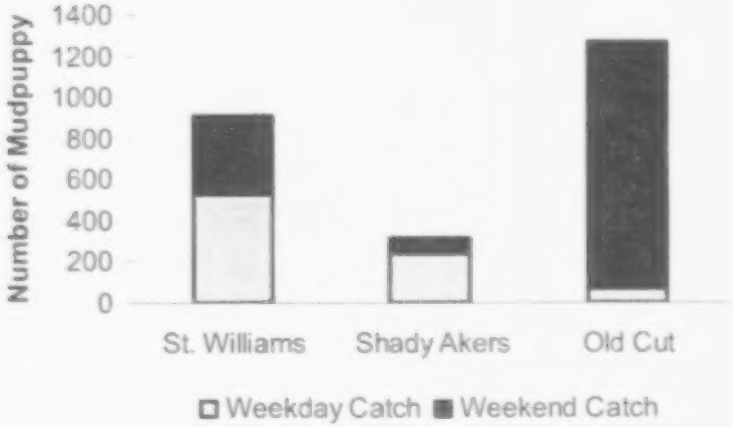

Figure 12. The proportion of the total catch of mudpuppy caught during weekdays and weekends.

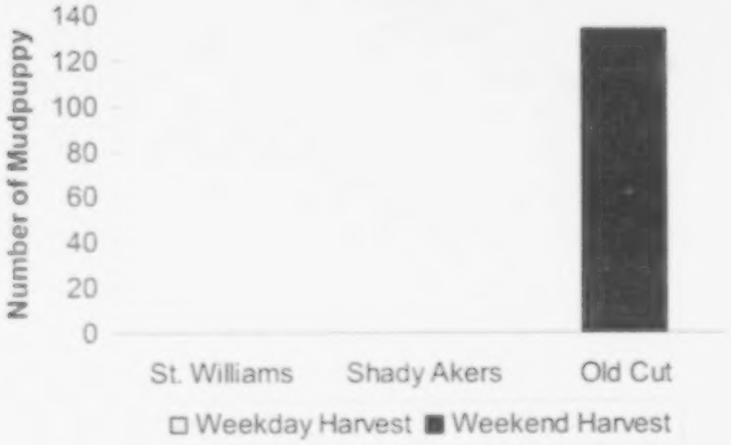

Figure 13. The proportion of the total harvest of mudpuppy caught during weekdays and weekends.

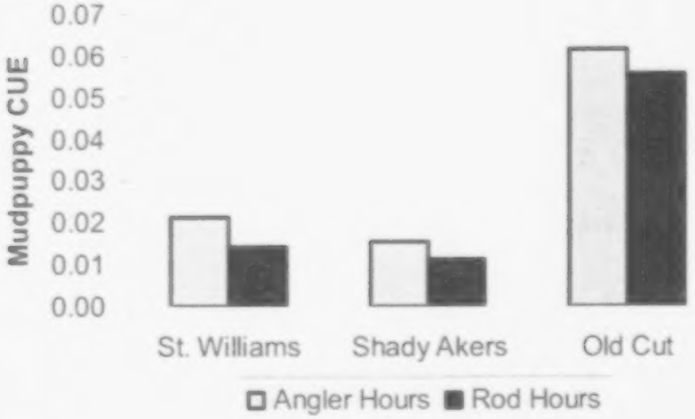

Figure 14. Catch per unit effort for mudpuppy caught in three areas in Inner Long Point Bay during the winter creel survey, reported in angler and rod hours.

Table 1. Catch, harvest, and CUE estimates for yellow perch, northern pike, and mudpuppies from winter ice-fishing surveys in Long Point Inner Bay.

Year	Yellow Perch			Northern Pike			Mudpuppy		
	Catch	Harvest	CUE	Catch	Harvest	CUE	Catch	Harvest	CUE
1960[1]		510,992							
1962[1]		243,981			12				
1963[1]		306,192							
1964[1]		36,370			10				
1966[1]		53,350							
1967[1]		9,732							
1968[1]		87,231			62				
1978[2]	150,909	120,813	1.47	271	271	0.003			
1979[2]		314,600	4.45		158	0.001			
1980[2]	442,888	264,219	8.72	393	245	0.025			
1982[2]	591,460*	401,727*	5.38	80*	80*	0.002			
1984[2]	379,464	275,954	3.78	551	541	0.005			
1985[2]	28,903	18,973	0.68	66	64	0.002			
1986[2]	160,014	115,382	2.02	235	235	0.003			
1988[2]	58,445*	39,014*	1.92	127*	127*	0.003			
2004	535,400	236,052	3.70**	385	295	0.007	2,484	133	0.02

[1] Source: Sztramko and Paine 1982

[2] Source: Timmerman 1988

* St. Williams harvest, catch, and CUE estimates combined with Port Rowan estimates. All other estimates were from St. Williams except those reported for 2004 where estimates are based on data collected from St.Williams, Shady Akers, and Old Cut.

** CUE estimates produced from estimated number of a species caught divided divided by the estimated effort in rod-hours. All other CUE estimates are based on observed number of a species caught divided by the observed effort in rod-hours.

Table 2. Mean length (mm), mean weight (g), and mean age (years) of yellow perch sampled during winter ice-fishing surveys in Long Point Inner Bay.

Year	Mean Length (mm)	Mean Weight (g)	Mean Age (yrs)
1980*	181		3.2
1982*	178	72.5	3.2
1984*	192	77.3	3.6
1985*	186	73.0	3.6
1986*	195		4.0
1988*	185	72.9	4.1
2004	196	125.1	3.8

* Timmerman 1988

Table 3. Historical and present-day residency status of angling parties in the Inner Long Point Bay winter ice-fishery.

Year	% Local	% Ontario	% Non-Resident
1978*		95.0	5.0
1980*	92.0	8.0	0.0
1982*		99.0	1.0
1984*		100.0	0.0
1988*	46.0	63.0	1.0
2004	63.3	36.4	0.2

* Timmerman 1988

Lake Erie Management Unit
Ontario Walleye Scale/Otolith Ageing Comparison
Prepared by: M. Belore and B. Locke

Introduction

Walleye support multi-million dollar recreational and commercial fisheries in Lake Erie. As a result of this, harvest of this species is closely monitored by the four U.S. states and one Canadian province that border the lake. Catch-at-age harvest data from both the recreational and commercial fisheries is input into a catch-at-age model which estimates the annual population of walleye in Lake Erie (Deriso et al. 1985, WTG 2004). Accurate age estimates are important to this model in order for the model to precisely estimate year class strength, survival, and total population abundance. These values are used to determine the total allowable catch that can be safely harvested from Lake Erie.

Historically, catch-at-age estimates used in the model have been based on scale aged fish. Scales are easy to collect from fish and do not require the fish to be sacrificed. However, scales may be difficult to age due to false annuli and crowding of annuli at the scale margin (Robillard and Marsden 1996, Beamish and McFarlane 1987). On the other hand, studies have shown that otoliths provide more precise age estimates than scales (Kocovsky and Carline 2000, Niewinski and Ferreri 1999, Robillard and Marsden 1996, Beamish and McFarlane 1987).

Age data is used by Lake Erie fisheries biologists to estimate the number of walleyes in the population, determine growth rates, and ascertain the age of sexual maturity. Incorrect ageing structures have the potential to over or under estimating these parameters. For example, scales tend to under-age fish, consequently growth rates may be exaggerated (Beamish and McFarlane 1983). In addition, ageing errors may cause population models to underestimate survival and overestimate mortality. This could result in the model overestimating the abundance of the walleye population, and permitting total allowable catches that exceed a safe harvest level (Beamish and McFarlane 1983).

The purpose of this study is to compare the ages determined from scales and otoliths of walleyes collected from various management units in Lake Erie to decide whether or not the Ontario Ministry of Natural Resources commercial catch sampling program requires walleye to be aged using otoliths or if the program should continue to age walleye using scales.

Methods

Scale and otolith samples were taken from walleye during the Ontario Partnership program in the fall of 2003. The majority of the samples were taken from the west basin (145) with 19 from the central basin and 50 from the east basin. The number of samples used was based on length intervals with approximately the same number of samples taken from each 25 mm length interval. Scale impressions were imprinted onto slides before reading. Otoliths were embedded in epoxy and sectioned. The ageing structures were read by individuals that routinely age walleyes from Lake Erie and have considerable experience ageing each structure. Scales and otoliths were each aged by two difference people, the ages given by the first reader are referred to as scale age

1 and otolith age 1, and the ages given by the second reader are referred to as scale age 2 and otolith age 2.

Results and Discussion

In total, 214 fish were aged. There was 84 percent agreement between the two readers of the scales. This was the same for the otoliths. This was contrary to findings by Kocovsky and Carline (2000) who found that percent agreement between readers was higher for otoliths than for scales. The low percent agreement for otoliths in this study might be due in part to the experience level of the readers, with one reader being an experienced otolith reader and the other a novice. On the other hand, a larger number of otolith samples had percent agreement ±1, than the scale samples (Table 1). The scale ages matched each other exactly up until age 5, after this there was an increasing amount of disagreement up until the highest scale age of 15 (Figure 1). There was some disagreement between the otolith ages at young ages, however, the disagreement did not increase with older ages (Figure 2).

When comparing the first scale age (first reader) to the first otolith age there was a 94% agreement when the otolith age was less than or equal to 4. When the otolith age was between 5 and 10, there was a 59% agreement, and when the otolith age was larger than 10 there was 0% agreement (Table 2). Agreement between the otolith age and the scale age was close up until age 8, after age 8 the scale age tended to be lower than the otolith age and have a larger standard deviation (Figure 3).

The average percent error (APE, Beamish and Fournier 1981) and the coefficient of variation (CV, Chang 1982) were calculated for all samples (4 age estimates), scale samples (2 age estimates) and otolith samples (2 age estimates) (Table 3). APE is used as an estimate of the precision (reproductibility) of age determinations (Beamish and Fournier 1981). The CV also provides a statistical test of reproductibility of age estimates. However, because the CV uses variance instead of absolute difference it may be a stronger estimate than the APE in providing a test statistic (Chang 1982). The APE was lower for scales than for otoliths, however the CV's were the same for both, indicating similar amounts of error when reading each type of structure.

The scale age and otolith age agreed with each other up until a total fish length of approximately 450mm. Between 450-550mm the scale age was different from the otolith age 18% of the time (Figure 4). When the fish was longer than 550mm the scale and otolith age differed from each other 51% of the time. The number of years difference between the scale age and the otolith age increased with increasing length of fish (Figure 5).

Overall, scale age and otolith age agreed with each other up until age 8 or a total length of approximately 450 mm, with larger disagreement occurring in fish greater than 550 mm. For the purposes of the OMNR commercial catch sampling program it may be reasonable to continue to age Number 1 and Number 2 walleye using scales and to collect otolith samples to age Jumbo walleye (>533mm). However, there would still remain ageing error in fish lengths 450 to 533 mm, and using both scales and otoliths as ageing structures could cause confusion when sampling and analyzing data.

Table 1: Percent agreement between two readers for the same structure.

		% Agreement			
Structure	N	Exact	± 1	± 2	± 3
Scale	214	84%	97%	99%	100%
Otolith	214	84%	98%	100%	100%

Table 2. Percent agreement between structures (first scale age and first otolith age)

Otolith		Scale Agreement			
age	N	Exact	± 1	± 2	± 3
≤ 4	141	93%	99%	100%	100%
5-10	49	59%	100%	100%	100%
≥ 11	24	0%	21%	33%	42%

Table 3. Average percent error (Beamish and Fournier, 1981) and coefficient of variation (Chang, 1982) for all samples (4 age estimates), scales (2 age estimates) and otoliths (2 age estimates).

Metric	All Samples	Scales	Otoliths
Average percent error	4%	1%	2%
Coefficient of variation	5%	2%	2%

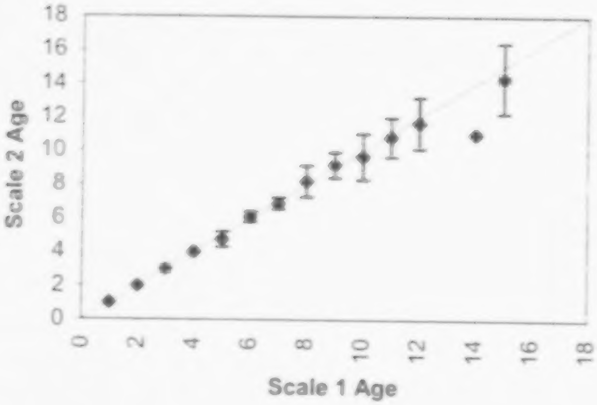

Figure 1. Scale age agreement between two readers (showing one standard deviation about the mean).

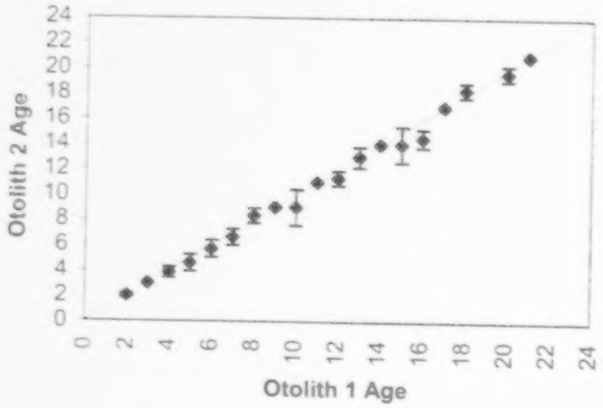

Figure 2. Otolith age agreement between two readers (showing one standard deviation about the mean).

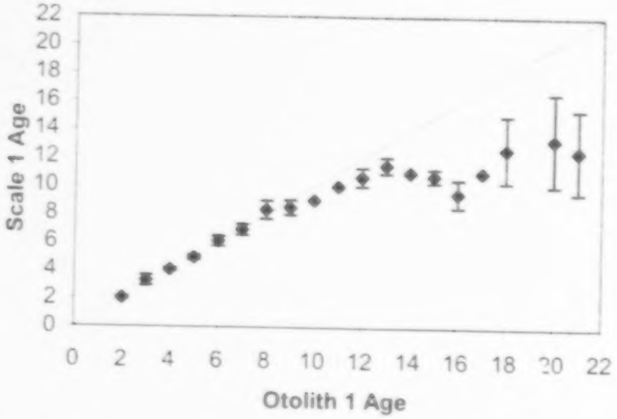

Figure 3. Agreement between the first otolith age and the first scale age (showing one standard deviation about the mean).

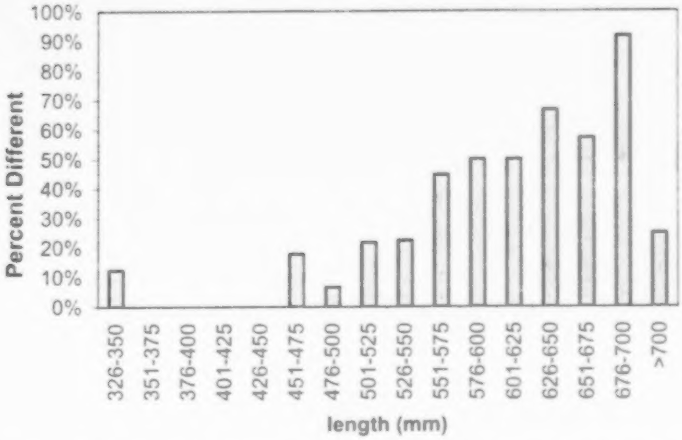

Figure 4. Percent of samples with a different scale age than otolith age by length group.

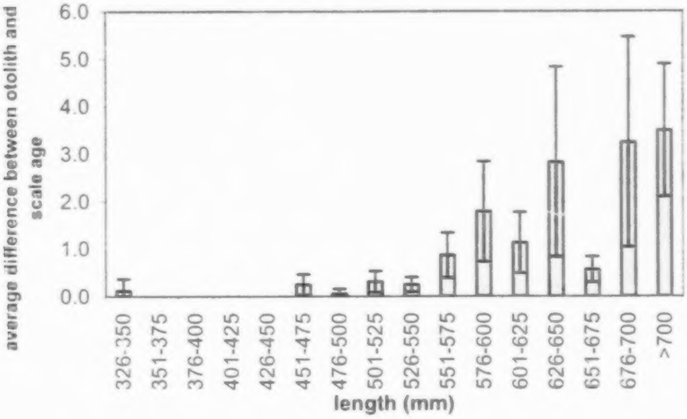

Figure 5. Average number of years difference between scale age and otolith age by length group (showing one standard deviation about the mean).

Acknowledgements

We thank Connie Isermann, Craig McDonald, and Larry Laforet for ageing the scales and otoliths. We also thank Chris Vandergoot of the Ohio Department of Natural Resources for writing the protocol of the Ohio-Ontario international walleye scale-otolith ageing study, which this study was a part of.

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Lake Erie Management Unit
2004 Lake Whitefish Survey Summary
Prepared by: M. Belore and B. Locke

Introduction

Lake whitefish (*Coregonus clupeaformis*) is an important commercial fish species in Lake Erie. In 2004, the Ontario commercial fishery harvested 617,000 lbs of whitefish, worth an estimated $690,000 (LEMU, 2005). In recent years, other Great Lakes have been experiencing declines in whitefish abundance and condition (Mohr and Nalepa, 2005), and in Lake Erie the mean age of whitefish in the commercial harvest has increased due to poor recruitment and the commercial CUE of whitefish has generally declined since 2000 (CWTG, 2005). However, few fisheries independent surveys exist that adequately describe the population dynamics of fish that have not yet recruited into fisheries, and to assess areas of the lake where fisheries are not prosecuted. Therefore, there is a need to improve the assessment of whitefish in Lake Erie in order to better understand the status of this valuable stock. The purpose of this study was to use a fishery independent gill net index to collect biological information about the Lake Erie whitefish population in order to determine the size and age structure of the lake whitefish spawning population in the western basin.

Study Area

The Lake Erie lake whitefish index gillnetting survey ran from October 25 until December 3, 2004. The survey took place in the Ontario waters of the west basin of Lake Erie. Nine sites were fished in total (Figure 1). Sites were located in known whitefish spawning areas, and locations traditionally fished by the commercial fleet in October, November and December. Site numbers correspond to commercial fishing grid numbers, with the exception of site 9 which was not fished in the correct location. Sites were not fished with equal effort. Those sites which produced greater numbers of whitefish were fished more frequently than sites which did not produce whitefish.

The survey used standard gangs of monofilament gillnet consisting of ten different mesh sizes. The nets included mesh sizes 2.25", 2.5", 2.75", 3", 3.5", 4", 4.5", 5", 5.5", and 6". Nets of each mesh size were 100 feet long (i.e. two 50' nets per mesh size). There were 25 samples in total, with six foot canned and bottom nets in each sample.

Results and Discussion

In total, 6522 fish were caught during this study, representing 20 different species (Table 1). The most frequently caught fish were walleye (39% of total catch), and 86% of the walleye were yearlings (Table 2). Other species caught include large numbers of white perch, yellow perch, freshwater drum, white bass and gizzard shad; along with smaller amounts of whitefish, channel catfish, white sucker, smallmouth bass, and others.

In total, 50 lake whitefish were caught during the study. In order to increase sample size of biological information, a further 40 whitefish were purchased from commercial fishermen who were fishing in the area, and these fish were sampled in the same manner as those that had been captured in the project. Whitefish catch numbers and CUE's reported here do not include these 40 commercially caught whitefish, however the summarized biological attributes of whitefish described in this report do include these 40 fish.

Site 25 (Hen Island) had the highest catch per unit effort (CUE) of all fish combined. This site had the highest CUE of whitefish, walleye, white perch, white bass, and freshwater drum (Figure 2). One bigmouth buffalo, which is a species of concern, was also caught at site 25. Smallmouth bass had their highest CUE at sites 26 and 27, near Pelee Island. Yellow Perch were broadly distributed throughout the sites, with the exception of poor catches at sites 12 and 26 (Figure 2). The average whitefish CUE was 2.0 fish/sample. During the 2002 fall whitefish survey, only 19 whitefish were caught, however the average whitefish CUE was 3.2 fish/sample. In this study, site 25 had the highest whitefish CUE, with 3.3 fish/sample. Site 11 (Colchester reef) had a whitefish CUE of 3.0 fish/sample, sites 26 and 18 had whitefish CUE's of 2.5 and 2.0 fish/sample respectively. Sites 10, 12 and 19 each had whitefish CUE's close to 1, and sites 9 and 27 did not produce any whitefish (Figure 2).

Attributes measured on the whitefish included total length, fork length, round weight, eviscerated weight, gonad weight (of females), gender, maturity, girth at the gills, and maximum girth. Lengths and weights of whitefish by age can be found in Table 3. Of the 90 total whitefish sampled in this project half were female and half were male. Whitefish ages ranged from 4 to 20, with most of the males comprising the lower age groups while the females tended to be older. This is consistent with the maturation schedule of whitefish in which males mature earlier than females (Henderson et al. 1983). The average age of the females was 9, while the average age of the males was 6. Overall the average age of whitefish caught was 8. Females were also generally larger than males in each age group, as observed by Van Oosten and Hile (1947). Dressed weight, gill girth, and maximum girth by sex and age can be found in Table 4.

The smallest mesh size that a whitefish was caught in was 70 mm. Most of the whitefish were caught in mesh sizes between 102 and 127 mm, although there were whitefish caught in mesh sizes up to the largest mesh size of 152 mm (Table 5). Thirty-six of the 50 whitefish caught during the project were captured in canned nets while 14 were in bottom nets. Sixty-five percent of the walleye were caught in mesh sizes 2.5" and less, and eighty-eight percent of the walleye were caught in mesh sizes 3" and less.

Of the 45 female whitefish, 13% were prespawning, 56% were spawning and 31% were spent. When the first whitefish were caught on November 3, they were all prespawning, and by the end of the project on November 30 75% of the females caught were spent (Table 6). This suggests that the majority of the spawning run took place during the project period. Due to the small sample size, a simple linear regression of percent females spent versus date was performed instead of the standard logistic regression. The regression indicated that 50% of female whitefish should be spent by November 24, and 75% by November 29 (r^2=0.91, N=4). These are the same dates for whitefish spawning in Lake Erie estimated by Cook et al. (2005). The regression also suggested that all mature female whitefish should be spent by December 3. A regression of water temperature versus percent mature females spent indicated that 50% of females should be spent when the water temperature reaches 7.2°C (r^2=0.99, N=4). This is different than the value determined by Cook et al. (2005) which indicated that 50% of female whitefish should be spent when the water temperature reaches 5.7°C. This is likely the result of warmer water temperatures during the autumn of 2004. In this study, spawning began when the water temperature was approximately 8.5°C, and 75% of female whitefish were spent when the water temperature was 6.6°C. Lawler (1965) estimated that optimal spawning temperature in Lake Erie was 6.1°C, and indicated that strong year classes did not occur when spawning took place at temperatures above 6.1°C. During the 2002 whitefish survey all of the whitefish caught were already spent. The 2002 project started late in the season (November 26) when the water temperature was 4.8°C.

The condition (condition = weight x 10^5 / length^3) of the whitefish was calculated using prespawning and spawning fish (spent fish were excluded). The average condition of females was 1.13, and the average condition of males was 0.98. This is comparable to the average condition for female whitefish from 2000 to 2004 in Lake Erie (1.11), and males (1.06) (CWTG, 2005), and the historical average condition (females 1.13, males 1.01) (Van Oosten and Hile, 1947).

A gonadosomatic index (GSI = (ovary weight/total weight) * 100) was calculated for mature prespawning female whitefish. The average GSI for prespawning females was 24%, and the highest value was 44%. This average is higher than the GSI of mature females in Lake Erie in 2000 and 2001, which was 17% and 19% respectively (Cook et al. 2005), and much higher than the GSI calculated for four other Ontario lakes, which ranged from 12% to 15% (Ihssen et al. 1981).

Subsamples of prespawning mature female whitefish ovaries were preserved in 70% isopropyl alcohol in order to estimate fecundity. In addition, whitefish stomachs were removed and preserved to analyze diet. This work has not yet been completed.

Recommendations

The 2002 whitefish survey caught only 19 whitefish, all of which were spent at the time of capture. After the 2002 whitefish survey, several recommendations were made to improve the project. The first recommendation was to begin the project earlier in the spawning season. This recommendation was followed and the 2004 project began during the last week of October. This allowed the project to catch whitefish before and during the spawning run in order to sample prespawning fish. The second recommendation, to run the project for more consecutive days during the week (instead of 2-3 days per week), was not followed due to personnel constraints. Because of this, it is difficult to accurately determine the date of whitefish spawning and its relation to temperature in the western basin of Lake Erie due to lack of sample data. The 2004 survey did follow the 2002 recommendation to fish one bottom and one canned net instead of two different lengths of canned nets. It is possible that this recommendation improved the results since approximately 28% of the whitefish caught were caught in bottom nets.

Some suggestions to improve the project in the future include removing the smallest two mesh sizes from the gang of index nets, and substituting larger mesh sizes in quarter inch increments (such as 4.25 and 4.75). This would decrease the time it takes for the field crew to remove small fish from the nets, and the addition of larger meshes would increase the probability of catching whitefish. In addition, future studies should include more sampling locations closer to the mouth of the Detroit River where commercial fisher's have harvested whitefish in recent years.

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Table 1. Number of fish caught by species (all samples combined).

Species Code	Common Name	Number caught
061	alewife	1
063	gizzard shad	234
076	rainbow trout	2
091	lake whitefish	50
121	rainbow smelt	1
132	muskellunge	3
161	quillback	16
163	white sucker	167
166	bigmouth buffalo	1
168	silver redhorse	1
170	golden redhorse	29
171	shorthead redhorse	12
234	channel catfish	58
301	white perch	1778
302	white bass	223
311	rock bass	11
316	smallmouth bass	73
331	yellow perch	885
334	walleye	2525
371	freshwater drum	452
Total		6522

Table 2. Walleye age composition, average length and average weight.

Age	Percent Age Composition	Average Total Length (mm)	Average Fork Length (mm)	Average Weight (g)
1	85.60%	309	289	262
2	0.21%	431	404	718
3	10.25%	468	441	1061
4	1.32%	507	478	1362
5	1.48%	536	504	1705
6	0.29%	534	503	1651
7	0.21%	596	564	2297
8	0.25%	613	575	2537
9	0.08%	632	598	2760
10	0.21%	623	589	2898
11	0.04%	670	638	3430
12	0.04%	571	539	2346
18	0.04%	571	539	1853

Table 3. Whitefish average length and weight by age (includes whitefish caught in survey nets and commercial catch samples).

	Sexes Combined				**Males**				**Females**			
Age	**N**	**Average Total Length (mm)**	**Average Fork Length (mm)**	**Average Round Weight (g)**	**N**	**Average Total Length (mm)**	**Average Fork Length (mm)**	**Average Round Weight (g)**	**N**	**Average Total Length (mm)**	**Average Fork Length (mm)**	**Average Round Weight (g)**
4	19	453	408	890	17	451	405	853	2	469	427	1202
5	16	482	434	1145	11	466	420	988	5	519	467	1492
6	10	513	465	1452	7	509	461	1344	3	524	473	1705
7	6	554	500	1860	3	549	497	1807	3	558	503	1912
8	10	546	492	1696	2	506	464	1256	8	555	500	1806
9	12	563	508	1860	3	565	509	1817	9	563	508	1875
10	4	604	547	2503	0				4	604	547	2503
11	1	610	555	2470	0				1	610	555	2470
12	3	569	512	1899	1	534	486	1376	2	586	525	2161
13	2	629	570	2791	0				2	629	570	2791
14	2	566	510	1948	0				2	566	510	1948
15	1	614	577	2031	0				1	614	577	2031
18	3	592	539	2188	1	558	503	2176	2	610	557	2194
20	1	660	603	3162	0				1	660	603	3162

Table 4 Whitefish average dressed weight, gill girth, and maximum girth by age and sex (includes whitefish caught in survey nets and commercial catch samples).

Age	Females				Males			
	N	Average Dressed Weight (g)	Average Gill Girth (mm)	Average Maximum Girth (mm)	N	Average Dressed Weight (g)	Average Gill Girth (mm)	Average Maximum Girth (mm)
4	2	918	203	290	17	799	169	241
5	5	1239	199	291	11	928	181	261
6	3	1249	218	334	7	1286	192	284
7	3	1474	214	345	3	1677	235	330
8	8	1426	208	319	2	1186	193	278
9	9	1438	225	317	3	1581	227	315
10	4	1838	244	368				
11	1	1616	229	314				
12	2	1665	201	332	1	1285	205	273
13	2	2326	270	378				
14	2	1406	198	326				
15	1	1608	240	333				
18	2	1953	244	321	1	2011	203	340
20	1	2750	241	384				

Table 5. Number caught, average length and average weight of whitefish by mesh size (includes only whitefish caught by survey index gillnets)

Mesh Size (mm)	Number Caught	Percent Catch	Average Total Length (mm)	Average Fork Length (mm)	Average Weight (g)
70	1	2%	444	394	748
89	8	16%	462	415	917
102	10	20%	478	429	1111
114	11	22%	535	481	1628
127	10	20%	569	514	1953
140	6	12%	581	529	2053
152	4	8%	579	523	2261

Table 6. Percent of mature female whitefish prespawning, spawning, and spent by date and water temperature (°C) (includes whitefish caught by survey index gillnets and commercial nets, water temperature was not available on November 10)

Date	Water Temp.	N	Prespawning	Spawning	Spent
Nov 3	12.1	6	100%	0%	0%
Nov 10		4	0%	100%	0%
Nov 16	8.5	1	0%	100%	0%
Nov 17	8.1	16	0%	88%	13%
Nov 23	7.0	10	0%	40%	60%
Nov 30	6.6	8	0%	25%	75%

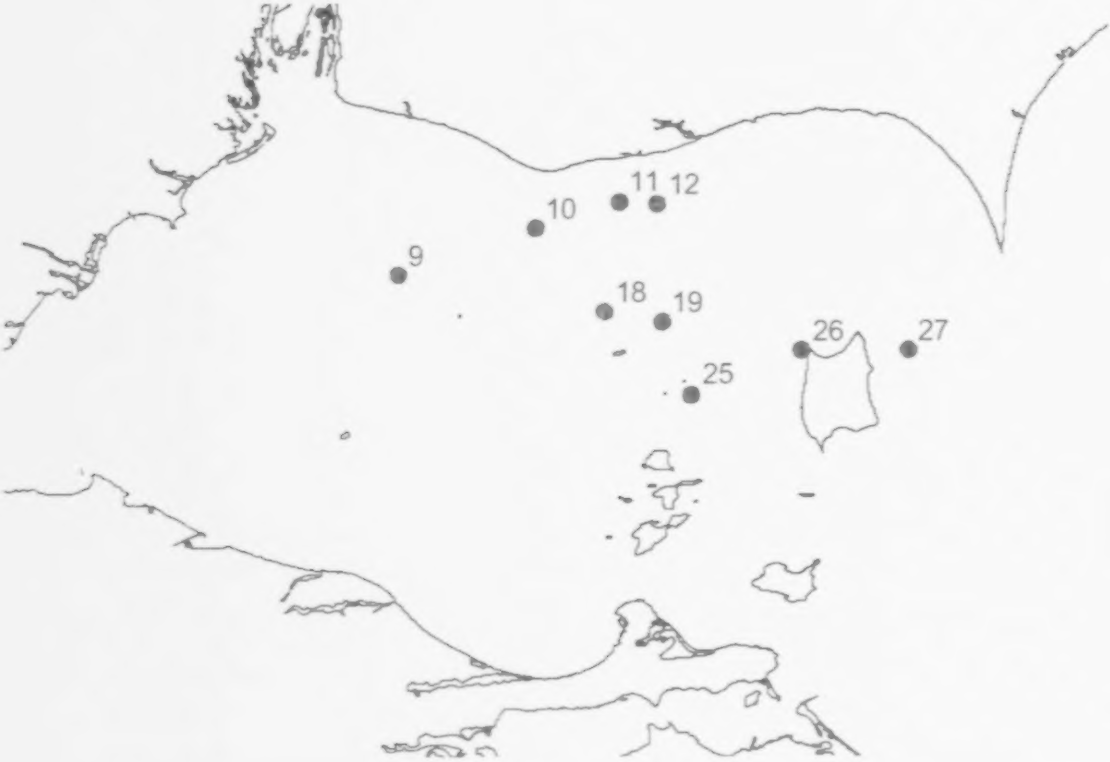
9
10
11
12
18
19
25
26
27

Figure 1. Approximate location of 2004 Whitefish Project Sample Sites

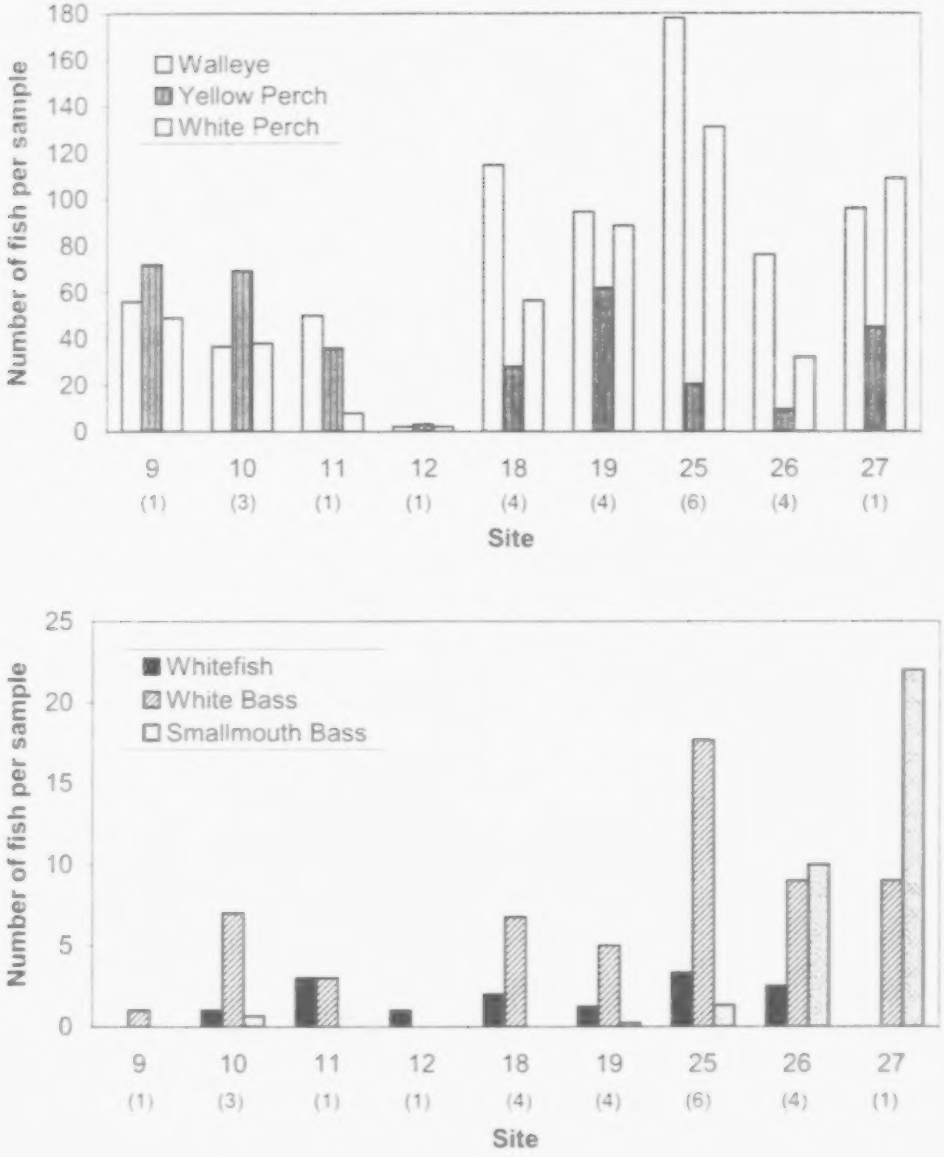

Figure 2. Catch per unit effort by sample site of selected fish species. Walleye, yellow perch and white perch are shown in the top figure; whitefish, white bass, and smallmouth bass are shown in the bottom figure. Numbers in brackets indicate number of samples for the site.

Lake Erie Management Unit Report 2005-1

Lake Erie Central Basin Access Creel Survey, 2004

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Table of Contents

List of Figures 3

List of Tables 4

List of Appendices 5

Introduction 6

Study Area 7

Methods 8

Results 9

- Distribution of Angling Effort 9
- Catch, Harvest, Catch Per Unit Effort Estimates 9
  - All Species 9
  - Yellow Perch 10
  - Rainbow Trout 10
  - Walleye 11
  - Smallmouth Bass 11
- Biological Characteristics of Harvest 12
  - Yellow Perch 12
  - Salmonids 12
  - Walleye 12
  - Northern Pike 13
- Diet Analysis 13
- Angler Profile 13
- Comparisons to Other Surveys 13
  - Previous Central Basin Aerial Creel Surveys 13
  - Angler Diary 2004 15

Discussion 17

Acknowledgements 18

References 19

List of Figures

Figure 1. Map of the Central Basin of Lake Erie, outlining the ports where interviews were conducted and fishing grids 20

Figure 2. Distribution of angling effort (rod hours) of boat anglers compared to shore anglers at each access point in the Central Basin 21

Figure 3. Catch per unit effort estimates for yellow perch in the central basin from June 7 to August 31, 2004. CUE calculations based on [observed catch/observed effort] for targeted and non-targeted (all) angling 22

Figure 4. Catch per unit effort estimates for rainbow trout in the central basin from June 7 to August 31, 2004. CUE calculations based on [observed catch/observed effort] for targeted and non-targeted (all) angling 23

Figure 5. Catch per unit effort estimates for walleye in the central basin from June 7 to August 31, 2004. CUE calculations based on: observed targeted catches / observed targeted effort (top graph) OR total observed catch/total observed effort (bottom graph) 24

Figure 6. Catch per unit effort estimates for smallmouth bass in the central basin from June 7 to August 31, 2004. CUE calculations based on: observed targeted catches / observed targeted effort (top graph) OR total observed catch/total observed effort (bottom graph) 25

Figure 7. (a) Length composition (n=56) and (b) age composition (n=63) of yellow perch caught in the central basin from June to August 2004 26

Figure 8. (a) Length composition (n=84) and (b) age composition (n=44) of rainbow trout caught in the central basin from June to August 2004 27

Figure 9. (a) Length composition (n=20) and (b) age composition (n=18) of walleye caught in the central basin from June to August 2004 28

Figure 10. Total boat angling effort estimates (rod-hours) from central basin aerial creel surveys (1990-1998) and access point survey (2004). Note: The 2004 data denoted by * includes effort from both boat and shore angling 29

Figure 11. Success rates (fish/ rod-hour) for walleye from boat angling during central basin aerial creel surveys (1990-1998) and an access point survey (2004) 30

Figure 12. Success rates (fish/ rod-hour) for smallmouth bass from boat angling during central basin aerial creel surveys (1990-1998) and an access point survey (2004) 31

Figure 13. Success rates (fish/ rod-hour) for yellow perch from boat angling during central basin aerial creel surveys (1990-1998) and an access point survey (2004) 32

Figure 14. Success rates (fish/ rod-hour) for rainbow trout from boat angling during central basin aerial creel surveys (1990-1998) and an access point survey (2004) 33

Figure 15. The proportion of estimated total effort directed at walleye, yellow perch, smallmouth bass, and rainbow trout during central basin aerial creel surveys (1990-1998) and access point survey (2004) 34

List of Tables

Table 1. Details concerning the access points (ports) used in the Central Basin Access Point Creel Survey 35

Table 2. Estimated angling effort, catch, harvest, and CUE from the Access Point Creel Survey, Central Basin, Lake Erie, June 7-August 31, 2004 (RSE= relative standard error) 36

Table 3. Estimated angling effort, catch, harvest, and CUE for yellow perch for each access point from the Access Point Creel Survey, Central Basin, Lake Erie, June 7-August 31, 2004 (RSE= relative standard error) 37

Table 4. Estimated angling effort, catch, harvest, and CUE for rainbow trout for each access point from the Access Point Creel Survey, Central Basin, Lake Erie, June 7-August 31, 2004 (RSE= relative standard error) 38

Table 5. Estimated angling effort, catch, harvest, and CUE for walleye for each access point from the Access Point Creel Survey, Central Basin, Lake Erie, June 7-August 31, 2004 (RSE= relative standard error) 39

Table 6. Estimated angling effort, catch, harvest, and CUE for smallmouth bass for each access point from the Access Point Creel Survey, Central Basin, Lake Erie, June 7-August 31, 2004 (RSE= relative standard error) 40

Table 7. The distribution of angling methods used by angling parties in the central basin of Lake Erie from June 7 to August 31, 2004 41

Table 8. The distribution of angler origin in the central basin of Lake Erie from June 7 to August 31, 2004 41

Table 9. The distribution of angler visitor status in the central basin of Lake Erie from June 7 to August 31, 2004 42

Table 10. Estimates of total central basin effort and estimates of targeted effort, catch, harvest, and catch per unit effort for walleye, yellow perch, smallmouth bass, and rainbow trout from central basin aerial creel surveys (1990-1998) and an access point survey (2004); with data from Sztramko (2000) 43

List of Appendices

Appendix 1. An example of the OMNR Creel Log Form No. 948 (84/03) 44

Appendix 2. Expanded description of FISHNET calculations used to produce creel estimates (Lester and Korver, 1996) 45

Introduction

Lake Erie is geologically the oldest, smallest by volume, second smallest by area, and shallowest of the five Great Lakes. The lake has a surface area of 25,700 km^2, an average depth of 19m/62 ft, and is the warmest and most biologically productive. With over 130 fish species, Lake Erie supports the second-largest sport fishery on the Great Lakes today, and the walleye fishery is generally considered as one of the best in the world.

The Ontario Ministry of Natural Resources (OMNR) has been conducting creel census surveys on Lake Erie for over 40 years to estimate fishing pressure and harvest of fish species from a series of boat counts and angler interviews. These surveys monitor trends in population size, harvest and growth rate of species, and assist in future management decisions of the fisheries.

In 1998, OMNR, in partnership with the Ontario Federation of Anglers and Hunters (OFAH), completed the most recent lake-wide aerial creel survey that combined estimates of angling effort (determined from aerial counts of boats) with estimates of fishing success (determined from complete trip angler interviews). This information was used to determine total catch and harvest of a variety of important fish species in Lake Erie.

The 1998 survey revealed that angling effort was distributed unevenly across the lake (Western Basin 13%, Central Basin 16%, Long Point Areas 45% and Port Colborne Area 26%; Sztramko 2000). Overall, angling effort had increased by 33% from 1992, mainly due to the regulation change in 1996 that increased the number of rods used per angler from one to two in the offshore fisheries for walleye and salmonids (Sztramko 2000). The lake wide catch per unit effort (CUE) for walleye decreased by 58% in 1998 compared to 1992, despite CUE increases in the western and eastern basins. This was attributed to lower angler success rates in the central basin (Sztramko 2000).

Creel census surveys have also been carried out that concentrated on specific areas of the lake. In 1999, OMNR conducted a creel survey jointly with the New York State Department of Environment Conservation (NYDEC) to determine estimates of angling effort, catch and harvest of all species on the upper Niagara River. Both agencies independently obtained interviews from their respective side of the Niagara River at selected access points, while NYDEC also completed an aerial survey.

In 2003, the Ministry of Natural Resources received funding from *Ontario's Living Legacy* Fish and Wildlife Protection and Enhancement program to conduct an access point creel survey on the eastern basin of Lake Erie (Arnold 2004). This survey assessed the state of the fishery throughout the eastern basin, including the Grand and Niagara Rivers.

Most recently, OMNR in partnership with the OFAH conducted an access point creel census survey in the Canadian waters of the central basin of Lake Erie during the summer of 2004. The objectives of this creel census were:

1. To quantify the catch and harvest of target species yellow perch (*Perca flavescens*), rainbow trout (*Oncorhynchus mykiss*), walleye (*Sander vitreus*), and smallmouth bass (*Mocropterus dolomieui*)
2. To monitor angler effort and success rates throughout the study area

3. To monitor the age, length and diet of species harvested by anglers
4. To profile the angling fishery
5. To compare results to previous creel information and consider change.

This was the first access creel survey concentrated solely on the central basin, thus allowing us to describe, for the first time in a quantitative manner, the sport fishery in this area of the lake.

Study Area

Lake Erie is naturally divided into three basins which, due to different physical characteristics, virtually function as three separate lakes. The western basin is very shallow with an average depth of 7.4 meters (24 ft) and a maximum depth of only 19 meters (62 ft). The central basin is quite uniform in depth, with an average depth of 18.3 meters (60 ft) and a maximum depth of 25 meters (82 ft). The eastern basin is the deepest, with an average depth of 25 meters (82 ft) and a maximum depth of 64 meters (210 ft). (LaMP 2000).

The study area for the creel survey consisted of the Canadian waters within the Central Basin of Lake Erie, westerly from Point Pelee to the Pennsylvania Ridge near Long Point (Figure 1). Six[1] major access points along the coastline were used to conduct boat counts and angler interviews for the survey:

01: Port Burwell
Two access points were targeted for interviewing boaters – Bradfield's Launch and Big Otter Marina. Shore anglers were interviewed on both sides of the main pier

02: Port Bruce
Two access points were targeted for interviews with boaters – Boblane Marina and North Erie Marina, both located upriver near the bridge. Shore anglers were interviewed along the main pier and the main beach.

03: Port Stanley
Two access points were targeted for interviews with boaters – Stan's Marina and the public launch. Shore interviews were conducted along the main pier.

04: Port Glasgow
There are two public boat launches within the same marina, just opposite each other that were targeted for interviews with boaters. Shore interviews were conducted at this site.

05: Erieau
There is only one access point in Erieau for boaters – Barney's Marina. Shore anglers were interviewed at the main pier.

06: Wheatley
The public launch at the end of the main pier in Wheatley Harbour was used for interviewing boaters. Shore anglers were interviewed at the main pier.

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[1] Note: Additional surveys were conducted which targeted anglers utilizing Rondeau Park and Rondeau Bay at Erieau however the information collected was limited and is not included in this report

Methods

The central basin creel survey was conducted over three months between June 7 and August 31, 2004. The survey was based on a stratified random design, where the fishery was characterized by strata (month, day type, time of day, access point or port and shore/boat fishing). Individual access point estimates (harvest, catch, and catch per unit effort) were calculated from interview and activity data.

The size of the study area warranted the use of two census crews. Each crew, consisting of two technicians, was located at a different base of operation. One crew operated out of Port Burwell Provincial Park, and was responsible for interviewing anglers in Port Burwell, Port Bruce and Port Stanley. The second crew operated out of Rondeau Provincial Park, and was responsible for Port Glasgow, Erieau and Wheatley. Table 1 outlines in detail what information was collected at each access point.

To adequately describe the fishery, sampling occurred 5 days per week: 3 weekdays and 2 weekend days. No sampling occurred on holidays due to availability of staff. The census periods (morning and afternoon) were six hours in duration. Morning periods began at 0800 hours and terminated at 1400 hours. Afternoon periods began at 1400 hours and ended at 2000 hours.

Only anglers that had finished fishing for the day were interviewed. At each port, the returning boat traffic was recorded directly by interviewers or monitored by camera and recorded later. Boats were classified as fishing or recreational as they entered the port to get a ratio of fishing to non-fishing boats for activity estimates. These counts included boats returning to the public launch and boats returning to private slips. Only anglers utilizing the public launch were contacted for interviews. Anglers who were shore fishing along piers at the access points were also interviewed. Anglers were asked a series of questions regarding their origin, method of fishing, angling location, type of species sought, number caught and number harvested. Data were recorded on OMNR Creel Log Form No. 948 (84/03) (Appendix 1).

When permitted, creel crews collected biological information from fish species harvested. Total and fork lengths were measured to the nearest millimeter and round weight measured to the nearest gram. Scale samples were also removed from the fish for age determination. Stomachs were removed from walleye and salmonids, and the gonad condition checked to determine sex and maturity. Fish stomachs were preserved in 70% isopropyl alcohol for later analyses. Stomach contents were identified when possible and volume was estimated. Standard lengths of prey species (measured from the tip of the head to the base of the caudal peduncle) were collected where possible

All data were entered and analyzed using Ministry of Natural Resources software, FISHNET Version 2 (Lester et al. 1989). Daily estimates of catch, harvest, and effort were calculated using the two-stage estimation formulae outlined in Appendix 3 (Lester and Korver 1996). The first stage of the estimation process was to obtain daily estimates, then the mean daily estimates for each stratum were multiplied by stratum size (i.e., number of days) to estimate totals for each stratum.

In order to compare 2004 estimates of effort, catch, harvest and success rates with those generated in previous creels, some data was pooled based on location within the central basin. MNR aerial creels surveys from 1990, 1991, 1992, and 1998 recognized two sub-basins, the western central basin and the eastern central basin. In 2004, for purposes of comparison, data collected from access points at Port Burwell, Port Bruce or Port Stanley, was grouped to create eastern central basin estimates while that collected at Port Glasgow, Erieau, or Wheatley was grouped to create western central basin estimates.

Results

Distribution of Angling Effort

Anglers spent an estimated 361,805 ± RSE = 7% rod-hours fishing in the central basin from June 7 to August 31, 2004. The majority of angling effort occurred during July (61.2%), with August next at 20.8% and June slightly lower at 18.0 %. More angling effort occurred on weekends (53.2 %) as compared to weekdays (46.8 %). Anglers seemed to prefer fishing later in the day, with 64.5% of the total angling effort occurring from 1400-2000, while the remaining 34.5 % occurred from 0800-1400.

Among the access points, the highest concentration of angling effort occurred at Erieau (42%), while Port Bruce was next at 23.4%. Between 10-11 % was estimated from each of Port Burwell, Port Glasgow and Wheatley, while only 1.9% was recorded at Port Stanley

The majority of angling effort occurred by boat, which made up 65.1% of the total estimated effort. Of this, 57.9% occurred at Erieau. Ports Bruce, Burwell and Glasgow were very consistent with 10-11% of the total boat effort, but only 0.6% occurred at Port Stanley. (Figure 2).

Shore anglers comprised 34.9% of the total estimated effort, with the highest level of shore fishing occurring at Port Bruce (46.5%). The least amount of shore effort was at Port Stanley (4.3%), while the other four access ports again showed very similar results between 10-14%.

Each angler fished with an average of 1.2 rods, and each angling party had an average of 2.2 anglers.

Catch, Harvest, Catch Per Unit Effort Estimates

All Species

Anglers caught an estimated 354,798 fish and harvested 193,753 (54.6 %, Table 2) between June 7 and August 31. Yellow perch had the highest estimated catch of 229,596 ± RSE=7% fish (harvest of 159,749), making up 64.7 % of the total fish caught and 82.4 % of the total fish harvested. Freshwater drum were the second most common fish caught, resulting in an estimated catch of 44,266 ± RSE=6% fish for the summer (12.5 % of the total catch and only 0.6 % of the total harvest).

Anglers also caught an estimated 29,075 round goby (8.2 % of total catch and 2.3 % of total harvest), 18,548 rainbow trout (5.2 % of total catch and 9.4 % of total harvest), 10,053 white bass (2.8 % of total catch and 1.3 % of total harvest), and 6,774 white perch (1.9 % of total catch and 1.2 % of total harvest). Pumpkinseed, walleye, largemouth bass, bluegill, rainbow smelt, and smallmouth bass were also caught and harvested at significant levels.

Yellow Perch

Yellow perch catch estimates were the highest of all species during the survey. Anglers caught 64.9 % of the yellow perch in July, 21.0 % in June, and 14.1 % in August.

Most of the yellow perch were caught out of Port Bruce (44.7 %) followed by Port Burwell (29.0 %), and Erieau (11.3 %, see Table 3).

From June through August, the catch per unit effort (CUE; based on observed numbers) for all anglers (those who targeted yellow perch combined with those who did not) was 0.8 fish/rod-hour. For those who targeted yellow perch, the CUE was much higher at 1.6 fish/rod-hour. The CUE was the highest in July, followed by August, then June. The CUE was also highest (almost double) for anglers fishing from boats compared to those fishing from shore.

The CUE for all anglers fishing out of Port Burwell was 1.5 fish/rod-hour (CUE for target anglers was 1.9 fish/rod-hour; Figure 3). The CUE for all anglers in Port Bruce was 1.4 fish/rod-hour, and the CUE for target anglers was 1.6 fish/rod-hour. Catch rates were moderate in Port Stanley and Port Glasgow (approximately 0.6 fish/rod-hour), and lowest in the west in Erieau and Wheatley (approximately 0.15 fish/rod-hour).

Rainbow Trout

Anglers caught an estimated 18,548 ± RSE=16% rainbow trout from June through August (Table 4). The majority of fishing effort for rainbow trout occurred in July (64.5%), followed by 25.1% in August and 10.4% in June. Of the total targeted effort, 70.8% was out of Erieau, followed by 13.7% out of Wheatley.

Eleven point six percent of the total catch was landed in June, 68.7% caught in July and 19.7% taken in August. Harvest estimates were very similar, with 11.7% taken in June, 68.9% taken in July and 19.4% taken in August.

Of the total catch, 65.1% came from Erieau and 22.7% out of Wheatley (Table 4). Total harvest was very similar again, with 66.3% from Erieau and 22.9% from Wheatley. Port Burwell, Port Bruce and Port Glasgow made up the remaining portion of the total catch and harvest. Rainbow trout were not caught at Port Stanley.

The catch per unit effort for all anglers from June through August was 0.051 fish/rod-hour. However, for those who targeted rainbow trout, the CUE was over double at 0.114 fish/rod-hour.

CUE's remained relatively consistent each month for all anglers as well as for those who targeted rainbow trout. Fishing success in June for all anglers was 0.03 fish/rod-hour (0.12 for target anglers), 0.05 fish/rod-hour in July (0.12 for target anglers), and 0.07 fish/rod-hour in August (0.11 fish/rod-hour for target anglers).

Fishing success rates were almost identical for anglers fishing out of Wheatley and Erieau, although over 65% of fishing effort was located out of Erieau. In Wheatley, CUE's were 0.11 fish/rod-hour for all anglers and 0.14 for target anglers (Figure 4). Erieau produced CUE's of 0.09 fish/rod-hour for all anglers and 0.12 fish/rod-hour for target anglers.

Walleye

Anglers caught an estimated 2,135 walleye, with 5.4% caught in June, 70.3% in July and 24.3% caught in August. Harvest estimates were very similar with 4.7% harvested in June, 73.6% in July and 21.7 harvested in August.

Estimates for individual access points are presented in Table 5. Catch and harvest estimates were highest for anglers who fished out of Erieau with 70.2% of the total catch and 74.1% of the total harvest. No Walleye were caught out of Port Stanley.

Fishing success was very low for all anglers at 0.01 fish/rod-hour. For those who targeted walleye, the CUE was 0.05 fish/rod-hour. Success rates were very similar at the five access points, ranging from 0.04 - 0.06 fish/rod-hour (Figure 5). CUE's were highest in August, followed by July and then June

Smallmouth Bass

The smallmouth bass fishery in the central basin was minor in comparison to other species, with an estimated 985 fish caught and 713 harvested (Table 6). Catches were highest in July (51.1%), followed by August (29.1%) and June (19.9%). Harvest estimates followed a similar trend (62.0% in July, 24.9% in August and 13.1% in June).

Of the six access points surveyed, smallmouth bass were caught from only three: Erieau, Port Burwell and Port Bruce. Fishing success was highest for anglers fishing out of Erieau, with 82.6% of the total catch and 97.5% of the total harvest. Port Bruce followed with 11.2% of the total catch and 2.5% of the total harvest. Port Bruce produced 6.2% of the total catch, but no fish were harvested.

The CUE estimate for smallmouth bass over all months (Table 2) was very low at 0.002 fish/rod-hour for all anglers combined, but increased to 0.194 fish/rod-hour for those anglers targeting them. CUE's were highest in July, followed by August, then June.

CUE's were highest out of Erieau where the majority of fishing effort, catch and harvest occurred (0.006 fish/rod-hour for all anglers; 0.38 fish/rod-hour for target anglers) (Figure 6).

Biological Characteristics of Harvest

Biological data were collected from yellow perch, walleye, northern pike and all salmonid species. Stomachs were removed from walleye and salmonids only for diet analysis.

Yellow Perch

Sixty-five yellow perch were sampled during the survey period from all areas over all months. Length and weight data were collected on 56 of these fish and scales samples for age determination were taken on 63 of them.

The mean total length of all fish was 252.5mm, with a mean weight of 226.7g. The largest yellow perch was caught at Pt. Burwell in July with a total length of 319mm and weighing 550.0g. Figure 7a illustrates the length class composition of the samples.

Of the 63 samples aged, 3 year olds were the dominant age group and comprised 41.3% of all age groups harvested. Age 5 fish were next at 34.9% and 12.7% were age 6. (Figure 7b) The mean age of all samples was 4.4 years.

Salmonids

A total of 84 Rainbow trout were sampled from all areas over all months. The mean total length was 624.0 mm, with a mean weight of 1235.1g. The largest rainbow was caught at Erieau in June and had a total length of 740mm and weighed in at 5,000g. Length and age compositions for rainbow trout are illustrated in Figures 8(a) and 8(b).

Forty-four rainbow trout were aged; 77.3% were age 3 fish, 14.6% age 4 fish and 9.1% age 2 fish. The mean age of all samples was 3.1 years.

Two Chinook salmon were also sampled from Area 4 (Port Glasgow) in July. Their mean total length was 663.5mm and an mean weight of 3,325g. One brown trout was also caught at Port Glasgow with a total length of 710mm and weighed 5,000g.

Walleye

Twenty walleye were sampled during the survey over all months. Of these, 55.0% were caught at Erieau, 30% at Port Glasgow and 5% at Pt. Bruce.

Eighteen walleye were aged, with ages ranging from 2 years to 11 years (Figure 9b). The mean total length of all twenty fish was 592.8mm and the mean weight was 2463.2g. The largest walleye was caught in late June out of Erieau with a total length of 750g and weighing in at 3500g. Length composition for all samples is illustrated in Figure 9a.

Northern Pike

One northern pike was sampled from Area 5, Erieau. It had a total length of 549mm; no weight was recorded. This fish was 4 years old.

Diet Analysis

Stomach analysis was limited as most anglers were reluctant to have the stomachs removed from their fish. All of the data reported in this section is a combination of all months (June, July, and August) and all locations.

Two Chinook salmon stomachs were removed and analyzed during the survey. One was empty and the other contained unidentifiable fish remains and one prey item belonging to the minnow family.

Sixteen walleye stomachs were also analyzed; ten were empty and six contained prey items. Three of the stomachs contained an average of 1.0 unidentifiable fish remains which had an average partial volume of 0.98 ml. One stomach had 7 adult smelt with an average partial volume of 1.8 ml and an average standard length[1] of 71mm. Another stomach contained an adult white bass with a standard length of 135mm and a volume of 20.0 ml. The last stomach contained 1 adult yellow perch with a standard length of 136mm and a volume of 30.0ml.

Rainbow trout stomachs were removed and shipped to Cornell University (Ithaca NY) for diet analysis. The results of this analysis will be combined with a lake wide diet study for this species, and reported separately.

Angler Profile

Interviews with anglers revealed information about their fishing methods, point of origin and accommodations.

In 2004, most boat anglers were still fishing (66.2 %), down rigging (18.4 %), or drift fishing (11.5 %, Table 7). The majority of angling parties originated locally (62.1 %) or from just outside the immediate area (within Ontario; 33.9 %, Table 8). Fifty-one percent of angling parties were permanent residents, followed by 43.2 % who were day trippers (Table 9).

Interviews also showed 96.0% of the parties were either local or lived in Ontario, and 3.9% were non-residents.

Comparisons to Other Surveys.

Previous Central Basin Aerial Creel Surveys

Results from the 2004 access point surveys were compared with similar estimates from previous aerial creel surveys, conducted in 1990, 1991, 1992, and 1998. Due to the nature of an aerial creel survey, previous summaries were calculated at a courser scale; they were based on the entire basin or western vs. eastern areas within the central basin rather than on individual ports. Additionally, the previous surveys did not include estimates of angling effort or success from the shore fishery. For comparative purposes, 2004 data was pooled into west central (Wheatley, Erieau, Port Glasgow) or east central basin (Port Stanley, Port Bruce, Port Burwell) categories. A summary of comparative measures is provided in Table 10.

Total angling effort (by boat) has not changed appreciably over the comparative time period. The estimate of total central basin angling effort in 2004 (234, 166 rod-hours) was very similar to estimates from 1991 and 1992; estimates were approximately 40% lower in 1990 and 1998 (Figure 10). In the earlier portion of this time series (1990-92) most of the effort (72%, 66% and 64%; respectively) occurred in the east-central basin. This relative contribution has declined with each survey so that in more recent years (1998 and 2004), the east central basin contributed less than half of the total central basin effort estimates (45% and 21%; respectively)(Table 10.).

Trends are apparent in targeted CUEs though the years. Angler success rates and effort expended can reflect changes in abundance of key sport fish species. Table 10 shows how CUEs have changed over time for walleye, smallmouth bass, yellow perch, and rainbow trout in the east central and west central sub-basins.

Walleye

Targeted walleye CUEs have steadily declined throughout the time series. In 2004 it took 5-14 times longer (depending on year and sub-basin) to catch a walleye than it did in the early 1990s (Figure 11). Walleye CUEs in 2004 were approximately half of what they were in 1998. The early trend of higher CUEs in the west compared with the east has changed so that in 1998, and 2004, there was little difference between sub-basins.

As the availability of walleye declined, and the amount of time to catch one walleye increased, anglers expended less effort trying to catch walleye. The proportion of total central basin angling effort directed at walleye has dropped dramatically from 90+ % in the early 1990s to 64% in 1998 and finally to 14% in this latest survey (Figure 15).

Smallmouth Bass

The smallmouth bass fishery remains concentrated in the western portion of the central basin. No (boat angling) effort has been expended on smallmouth bass in the east-central basin since 1991 and 1992[2]. Dramatic increases in effort in 1998 and 2004, were not reflected in higher CUEs which remained fairly constant (0.20 and 0.18 fish / rod-hour; respectively; Figure 12) and are considerably lower than the time series highs of 0.63 fish/rod-hour (west-central basin in 1990) and 0.86 fish/rod-hour (east central basin in 1991).

The proportion of total effort directed at smallmouth bass, despite increasing almost tenfold since the early 1990s, is still only 1% of the total central basin effort (Figure 15).

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[2] note: some effort was directed at smallmouth bass in the east-central basin in 2004 by the shore fishery as detailed under "results"

Yellow perch

Success rates for angling yellow perch, which had increased through the early 1990s, and then dropped in 1998, were higher than in any previous survey in 2004 both in the east-central (2.3 fish / rod-hour) and west-central basins (1.8 fish / rod-hour; Figure 13). In earlier years, CUEs were higher in the west than in the east (1991 and 1992) however in 1998 and 2004 they were higher in the east.

Effort targeted at yellow perch increased substantially between 1998 and 2004 in both sub-basins (Figure 13). This increase in effort is reflected in the proportion of total central basin effort directed at yellow perch (Figure 15); in 1991, '92, and '98, less than 2% of the total central basin effort was directed at yellow perch however this increased to greater than 27% in 2004.

Rainbow Trout

Success rates for rainbow trout in 2004 are twice as high as they were in 1990. In the east-central basin, CUE has been approximately 0.1 fish / rod-hour since 1991 while CUEs in the west-central basin only increased to this range in 1998 and 2004 (Figure 14). Effort directed at rainbow trout in the east-central basin has fluctuated throughout the survey time series while that in the west-central basin has risen successively from 3,300 rod-hours in 1992 to 67,000 rod-hours in 1998 to nearly 156,000 rod-hours in 2004. This 2004 effort represents the largest effort directed at a target species in any of the central basin creels; it is similar to the effort which was directed at east-central basin walleye in 1991 and 1992. The pattern of changes in proportion of total central basin fishing effort, for rainbow trout, show this pattern of effort switching from predominantly walleye in the early nineties to predominantly rainbow trout in the two most recent creels (Figure 15).

Angler Diary 2004

Estimates of individual species catch success rates from the OMNR Angler Diary program in 2004 were compared to estimates obtained from the concurrent creel survey. For these comparisons, June-August diary effort was compared to the June-August creel estimates which considered both shore and boat effort combined.

Similar to the creel results for walleye, most of the angler diary effort was focused on the west-central basin. However, where CUE was similar between east and west sub-basins in the creel (0.57 and 0.47 fish/rod-hour; respectively), it was lower overall for angler diarists (0.33 fish/rod-hour) and was much lower in the east compared to the west (0.019 and 0.037 fish/rod-hour; respectively).

For smallmouth bass, creel results showed a higher success rate in the west than in the east (0.4 and 0.067; respectively). While angler diarists only caught rainbow trout in the east-central basin (CUE for 0.312 fish/rod-hour), it should be noted that angler diarists only expended 12.8 rod-hours of effort on rainbow trout and that the CUE estimate is based on only 4 fish caught.

Angler diarists had much higher success rates for yellow perch than those reported to the creel survey. In the west-central basin diarists caught greater than 6 yellow perch per hour while in the east-central basin the estimate was nearly 2.5 per hour. CUE estimates from the creel survey were much lower than the diarist estimates and were slightly higher in the east than in the west of the basin (1.7 and 1.2 fish/rod-hour; respectively). The overall angler diary yellow perch CUE was 3.74 fish/rod-hour while that the overall estimate from the access creel survey was 1.60 fish/rod-hour.

Discussion

This survey, the first access creel focused solely on the central basin of Lake Erie, has allowed for detailed spatial data to be collected. Additionally it is the first time that the MNR has assessed the central basin shore fishery. Whereas the eastern basin shore fishery is dispersed and therefore hard to assess, the nature of the central basin (where much of the shore access curtailed by high cliffs) results in a concentration of shore fishing around port areas. This allowed for shore fishery catch, harvest, and success estimates to be derived in 2004. It is clear that the shore fishery, not surveyed in previous central basin creels, can contribute substantially to estimates of effort, catch and harvest, particularly for nearshore accessible species such as yellow perch. The total basin effort estimate in 2004 is 50% higher when the shore fishery data is added to the boat fishery data. Approximately 38% of both the yellow perch catch and harvest occurred in the shore fishery in 2004.

Patterns of central basin fishing were similar to those observed in eastern basin fishery in 2003 where most fishing took place between 2:00 pm and 8:00 pm and effort was nearly evenly distributed between weekday and weekends (Arnold, 2004). Seasonally, central basin fishing effort was heavily weighted toward July whereas eastern basin effort in 2003 was more evenly distributed through the season, and the highest effort occurred in August.

Yearly changes in fishing patterns within the central basin are a reflection of changes in both environmental conditions and the predominance of particular species within the basin. While total angler effort has changed little, species of choice have changed from predominantly walleye in the early 1990s to rainbow trout and, to a lesser degree, yellow perch, in recent years. Angler effort (by boat) has changed from being higher in the east-central basin during the early 90s to being higher in the west-central in 2004.

A sharp decline in lake wide CUE for walleye between 1992 and 1998 has been attributed mainly to declines in success rates in the central basin (Sztramko, 2000). Success rates for walleye in the central basin have continued to decline and in 2004 they were the lowest of the time series of creels whereas the most recent eastern basin creel (2003) has shown that walleye CUE in the eastern basin had increased slightly since 1998 (Arnold, 2004). These results may point to the fact that the angling fishery in the eastern basin is presently utilizing local stocks (Grand River and New York shoal stocks; OMNR, 2005) whereas central basin anglers are more reliant on numbers of western basin stocks moving eastward. Indeed, between 1990 and 2004, declines in targeted CUE occurred sooner in the east-central basin than in the west-central. Similarly, while targeted CUE for walleye is similar but low across the basin, patterns in walleye CUE for all anglers show that success increases the further west you travel in the central basin. Angler diary CUEs, usually higher than average, were comparable to the creel CUEs and were, similarly, higher in the west-central basin.

Patterns in yellow perch CUEs display the opposite trend; success increases as you move east for both targeted and non-targetted effort. Yellow perch constitute a much higher proportion of the central basin total catch (64%) than they do in the eastern basin fishery (where smallmouth bass catches are more substantial). The dominance of the total catch by yellow perch despite higher effort targeting rainbow trout speaks to both the abundance of yellow perch within the central basin and to the prized value of rainbow trout.

Success rates for rainbow trout fishing, similar to walleye, are higher out of the more western ports. Accordingly, angler effort in 2004 was concentrated in Erieau, Wheatley and Port Glasgow. Both the higher rainbow trout CUE and targeted effort in the central relative to the eastern basin is reflected in the relative proportions that they contribute to the total catch in each basin (5.2 and 0.3%; respectively). It is interesting to note that despite the large effort devoted to targeting rainbow trout in the central basin, a higher proportion of the total catch was made up of the exotic (nuisance) species, round goby.

Unlike the eastern basin fishery, where SMB are a major target for anglers (Arnold, 2004), smallmouth bass do not contribute greatly to the central basin fishery either in effort expended targeting them or in success rate. Unlike the eastern basin of the lake, the central basin fishery is not a SMB fishery.

Acknowledgements

The success of this survey was largely dependant on the cooperation of the angling public and the marina operators, all of whom were extremely helpful and kind. Jim Cook, Amber Spicer, Amanda Dawson, Mitch Stevenson, and Nick Russell should all be noted for their hard work and dedication while collecting field data over the three months of the survey.

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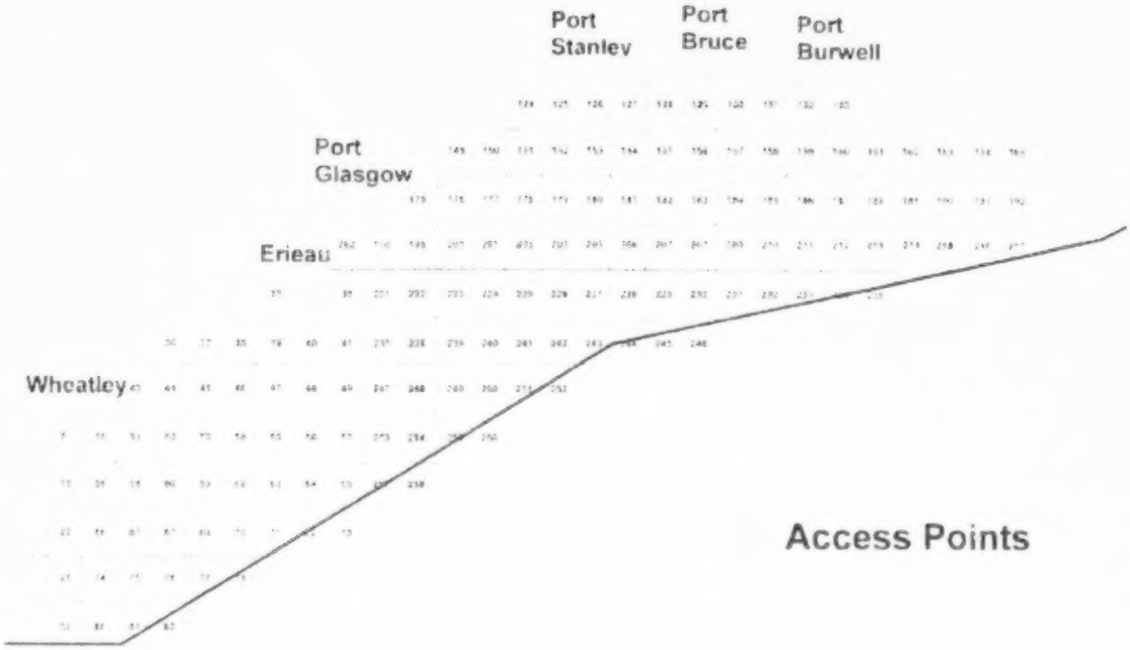

Port Stanley
Port Bruce
Port Burwell
Port Glasgow
Erieau
Wheatley
Access Points

Figure 1. Map of the Central Basin of Lake Erie, outlining the ports where interviews were conducted and fishing grids.

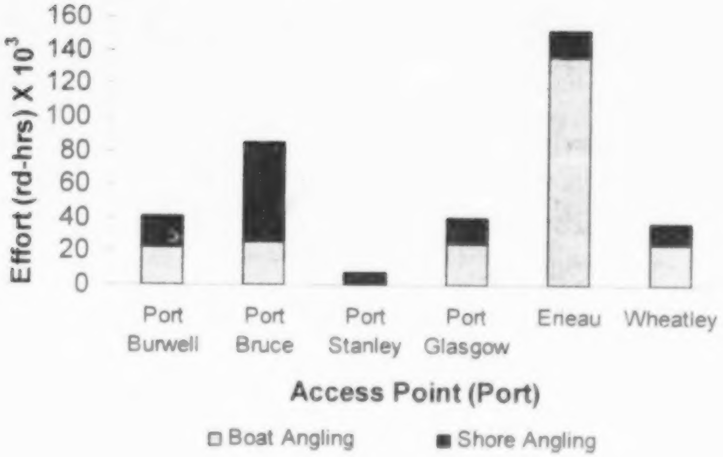


Figure 2. Distribution of angling effort (rod hours) of boat anglers compared to shore anglers at each access point in the Central Basin.

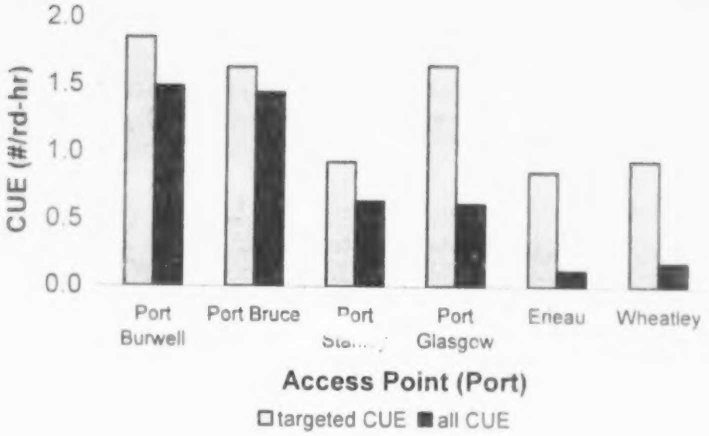


Figure 3. Catch per unit effort estimates for yellow perch in the central basin from June 7 to August 31, 2004. CUE calculations based on [observed catch/observed effort] for targeted and non-targeted (all) angling.

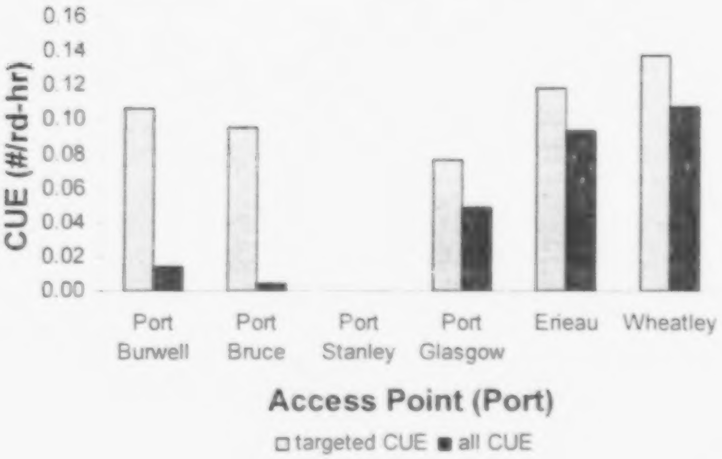


Figure 4. Catch per unit effort estimates for rainbow trout in the central basin from June 7 to August 31, 2004. CUE calculations based on [observed catch/observed effort] for targeted and non-targeted (all) angling.

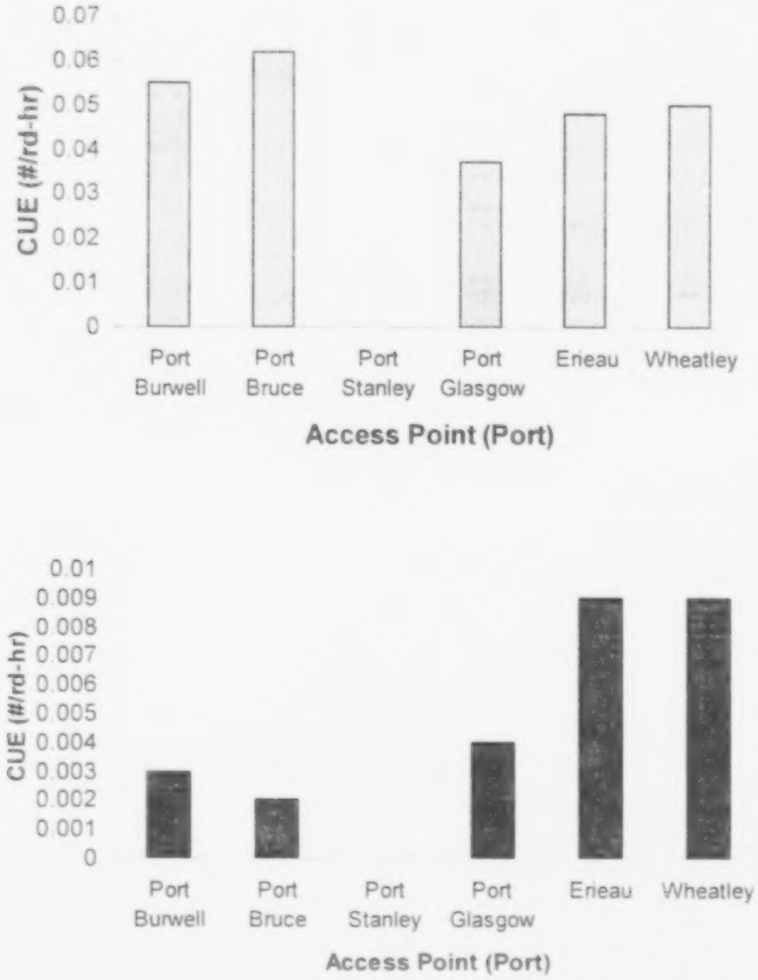


Figure 5. Catch per unit effort estimates for walleye in the central basin from June 7 to August 31, 2004. CUE calculations based on: observed targeted catches / observed targeted effort (top graph) OR total observed catch/total observed effort (bottom graph).

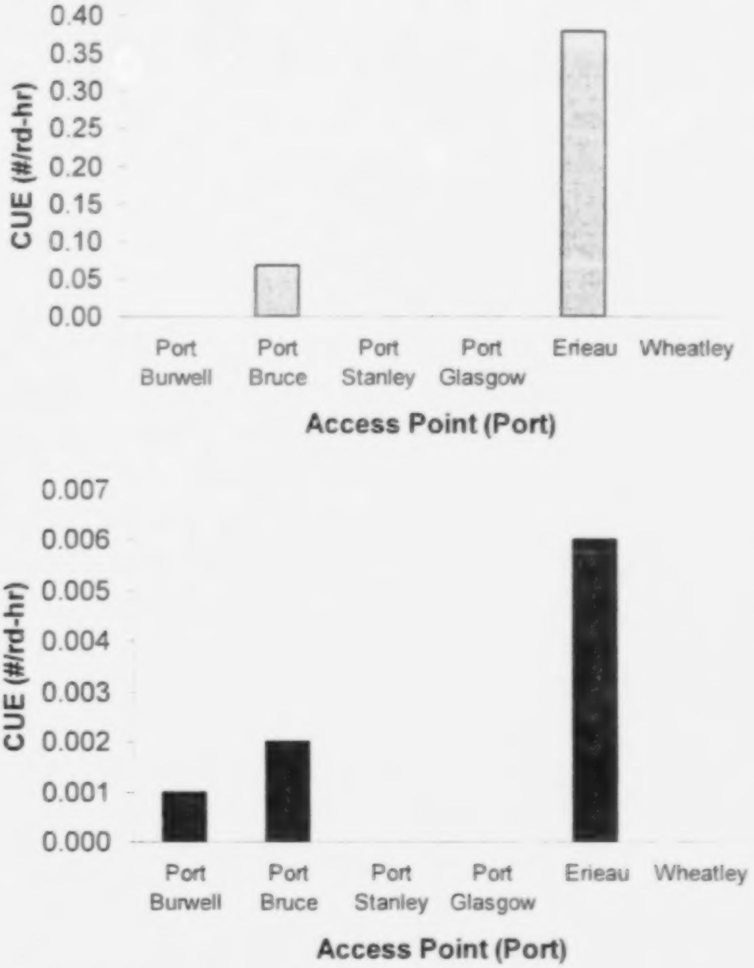


Figure 6. Catch per unit effort estimates for smallmouth bass in the central basin from June 7 to August 31, 2004. CUE calculations based on: observed targeted catches / observed targeted effort (top graph) OR total observed catch/total observed effort (bottom graph).

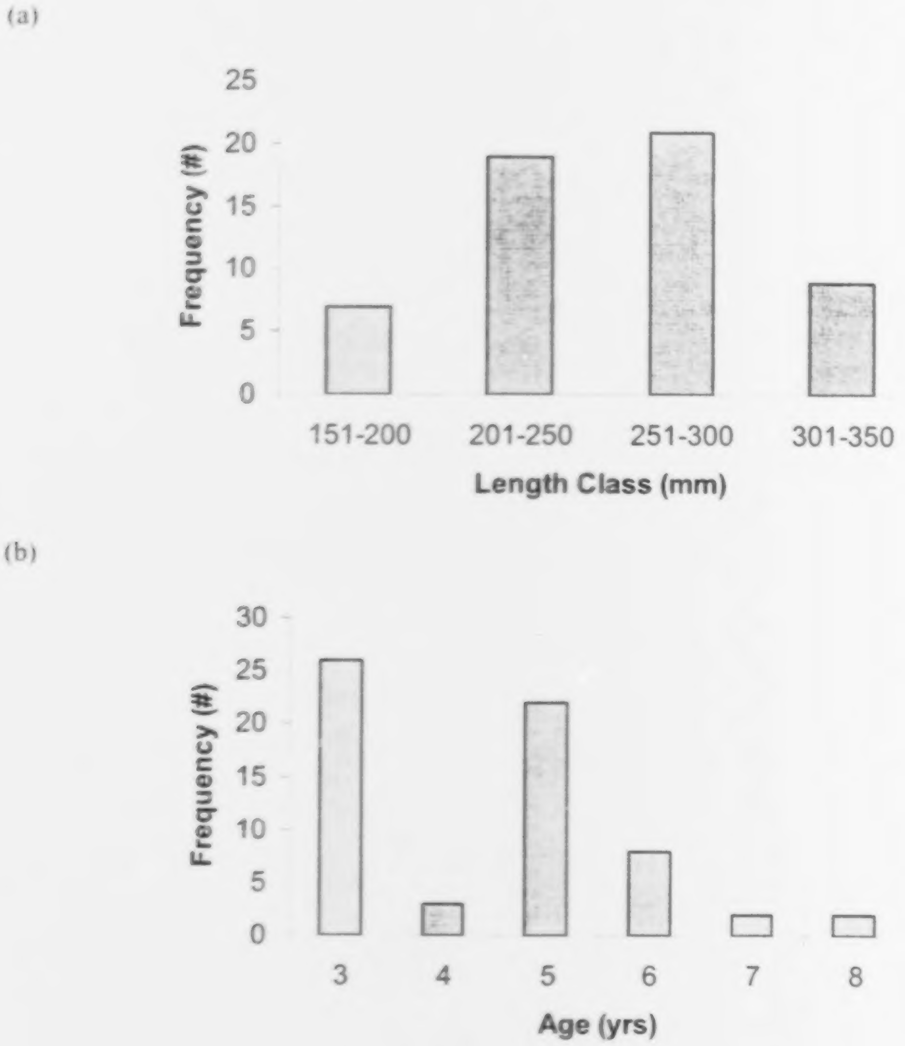


Figure 7. (a) Length composition (n=56) and (b) age composition (n=63) of yellow perch caught in the central basin from June to August 2004.

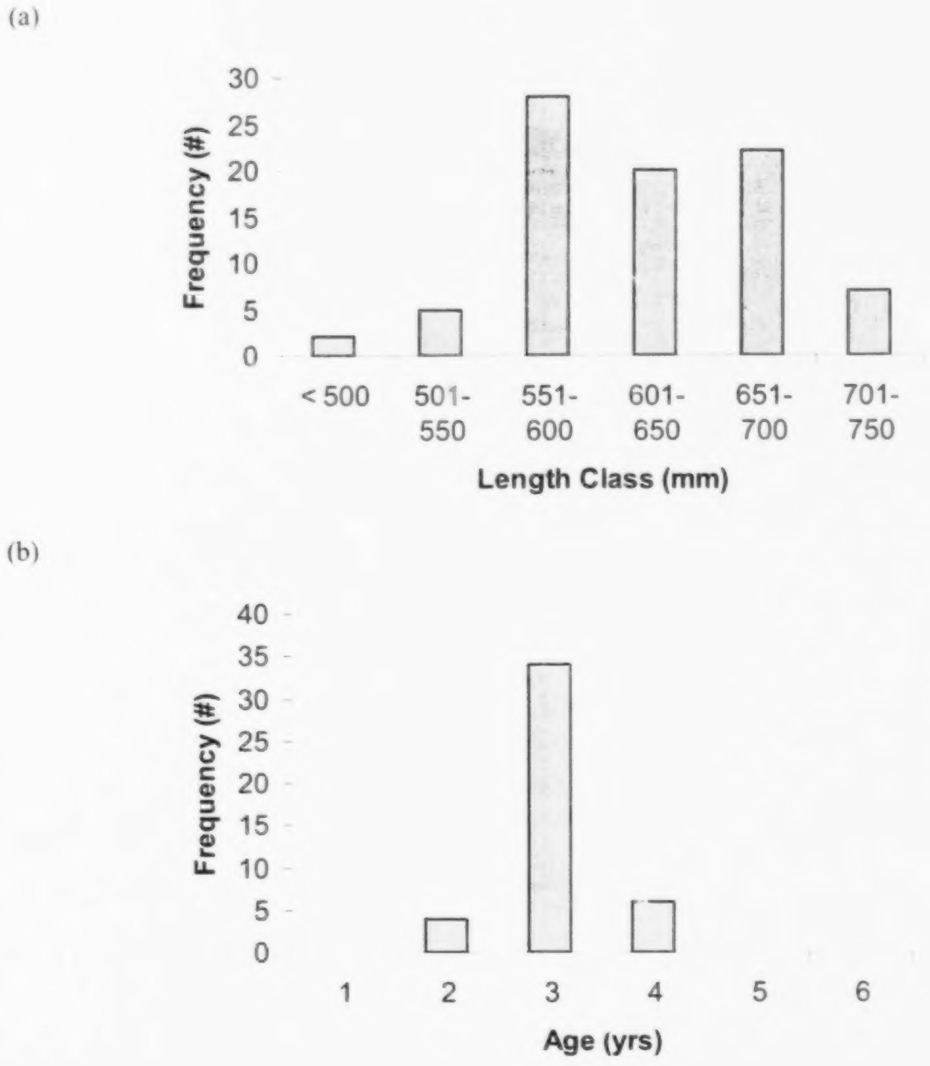


Figure 8. (a) Length composition (n=84) and (b) age composition (n=44) of rainbow trout caught in the central basin from June to August 2004.

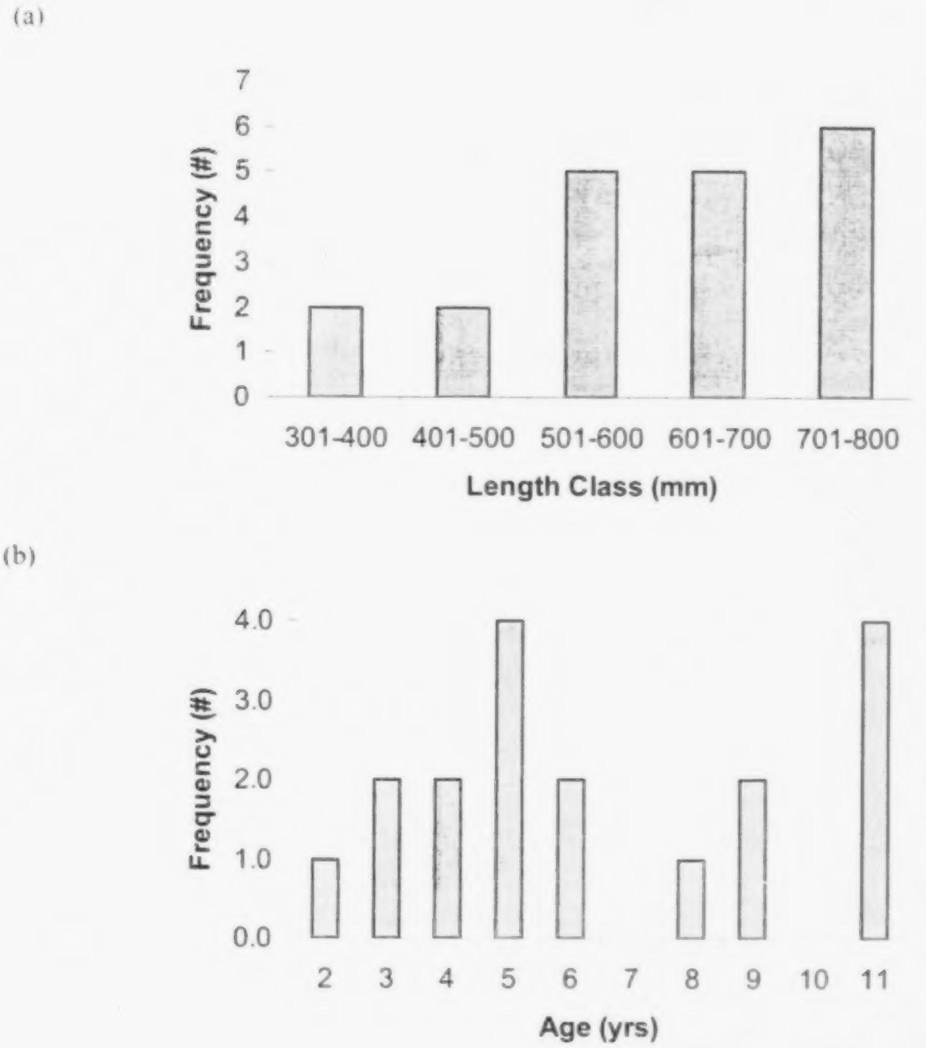


Figure 9. (a) Length composition (n=20) and (b) age composition (n=18) of walleye caught in the central basin from June to August 2004.

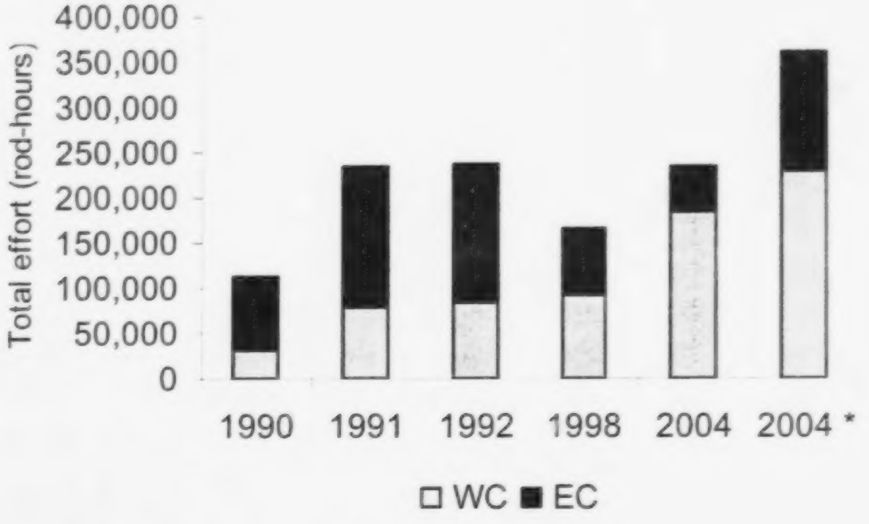


Figure 10. Total boat angling effort estimates (rod-hours) from central basin aerial creel surveys (1990-1998) and access point survey (2004). Note: The 2004 data denoted by * includes effort from both boat and shore angling.

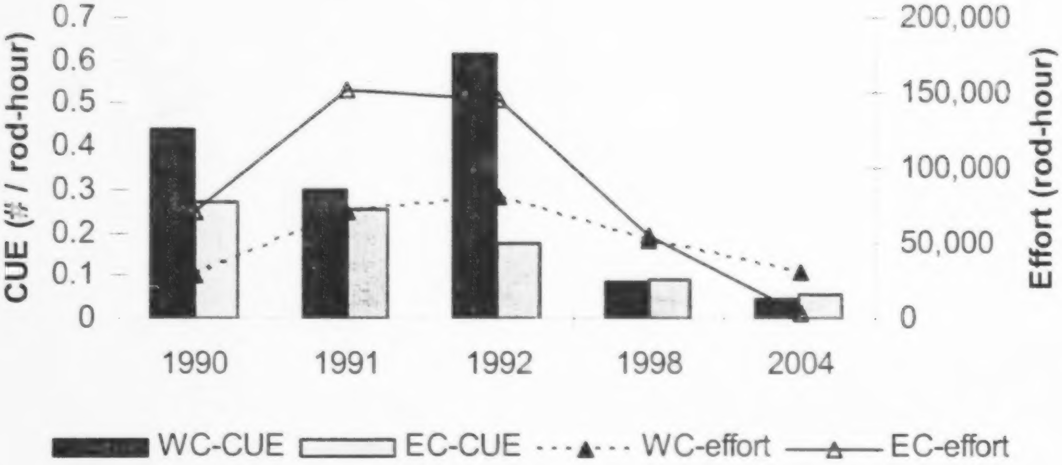


Figure 11. Success rates (fish/ rod-hour) for walleye from boat angling during central basin aerial creel surveys (1990-1998) and an access point survey (2004).

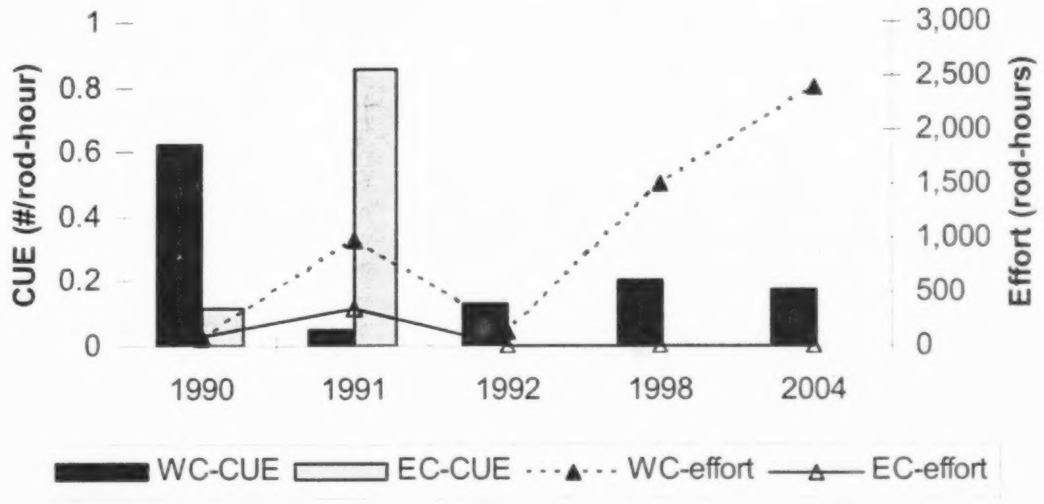


Figure 12. Success rates (fish/ rod-hour) for smallmouth bass from boat angling during central basin aerial creel surveys (1990-1998) and an access point survey (2004).

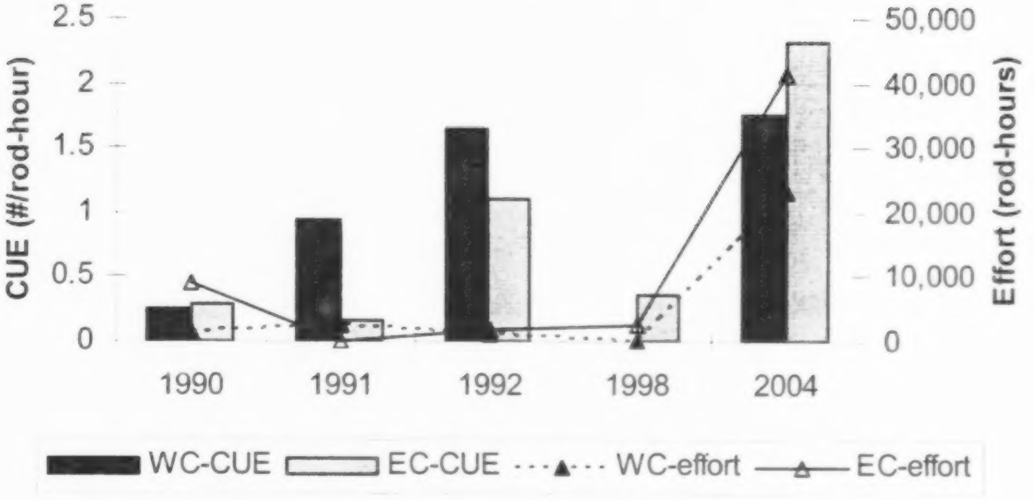


Figure 13. Success rates (fish/ rod-hour) for yellow perch from boat angling during central basin aerial creel surveys (1990-1998) and an access point survey (2004).

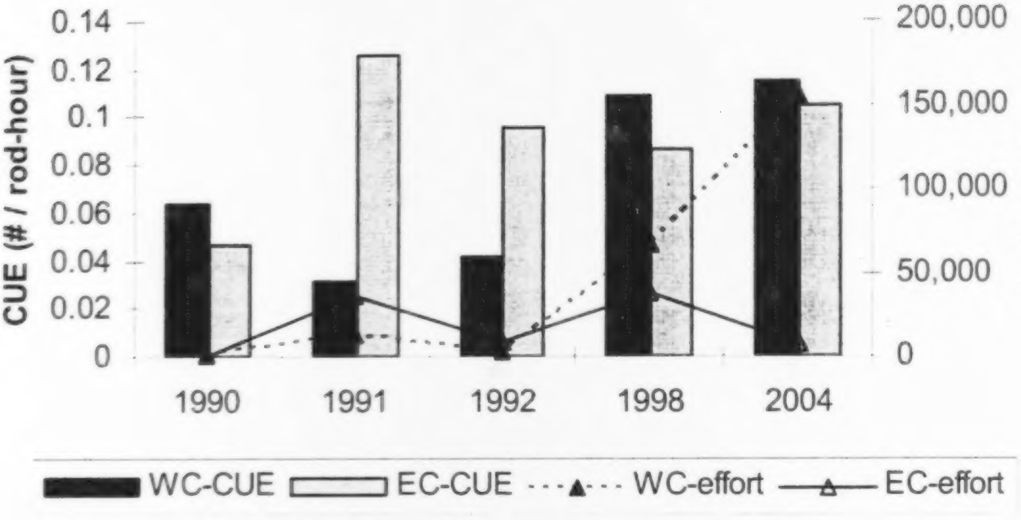


Figure 14. Success rates (fish/ rod-hour) for rainbow trout from boat angling during central basin aerial creel surveys (1990-1998) and an access point survey (2004).

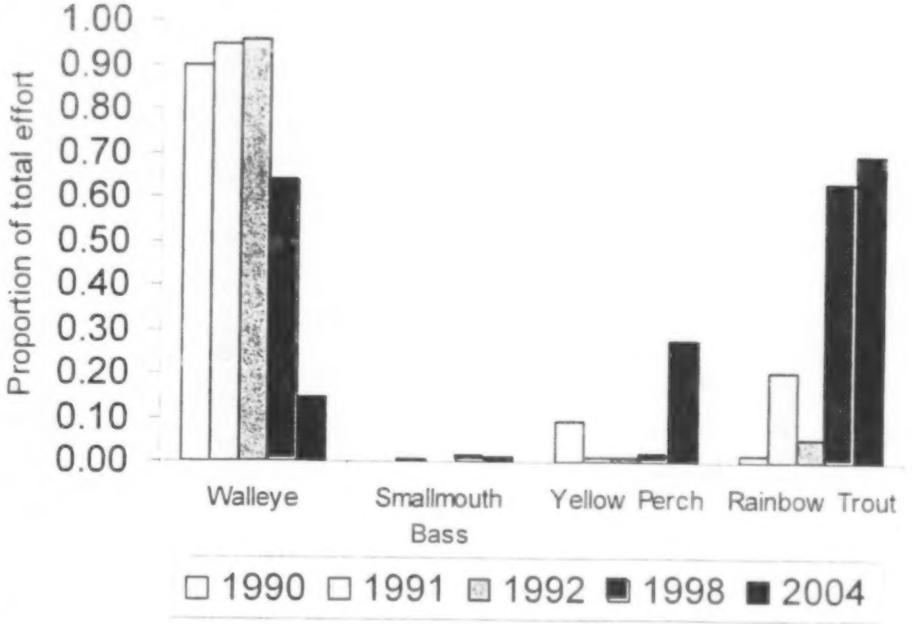


Figure 15. The proportion of estimated total effort directed at walleye, yellow perch, smallmouth bass, and rainbow trout during central basin aerial creel surveys (1990-1998) and access point survey (2004).

Table 1. Details concerning the access points (ports) used in the Central Basin Access Point Creel Survey.

Access Point (Port)	Fishing Mode	Launches Monitored at each Access Point or Port	Interviews Conducted	Camera Used for Activity Count
Port Burwell	1. Boat Angling 2. Shore Angling	1a. Bradfield's Launch (south of bridge) 1b. Big Otter Marina (north of bridge) 2a. Off main pier on both sides 2b. Within the park past boardwalk	1a. Yes 1b. Yes (limited) 2a. Yes (mainly west side) 2b. Yes	Yes (set up at mouth of channel on west side)
Port Bruce	1. Boat Angling 2. Shore Angling	1a. Boblane Marina 1b. North Erie Marina 2. Off main pier	1a. Yes 1b. Yes (limited) 2. Yes	Yes (set up at mouth of channel on west side)
Port Stanley	1. Boat Angling 2. Shore Angling	1a. Stan's Marina 1b. Public Launch (west side of channel) 2a. Off main pier 2b. Off rocks on east side of channel	1a. Yes (limited) 1b. Yes (limited) 2a. Yes (limited) 2b. Yes	Yes (set up on either side of channel)
Port Glasgow	1. Boat Angling 2. Shore Angling	1a. Public Launch (east side of marina) 1b. Public launch (west side of marina) 2. Along rocks (mainly east side of channel)	1a. Yes 1b. Yes 2. Yes	No (could count activity first hand)
Erieau	1. Boat Angling 2. Shore Angling	1. Barney's Marina 2. Off main pier	1. Yes 2. Yes	Yes (set up where the channel splits from the lake to the bay)
Wheatley	1. Boat Angling 2. Shore Angling	1. Public launch 2. Off main pier on both sides	1. Yes 2. Yes	No (could count activity first hand)

Table 2. Estimated angling effort, catch, harvest, and CUE from the Access Point Creel Survey, Central Basin, Lake Erie, June 7-August 31, 2004 (RSE= relative standard error).

Species	Targeted Effort (rd-hr)	%RSE	% Target	Est. Harvest (#)	% RSE	Est Catch (#)	% RSE	% of Total Harvest	% of Total Catch	Obs. CUE (all)	Obs. CUE (target)
Yellow Perch	169585	5	47	159749	7	229596	7	82.4	64.7	0.791	1.602
Rainbow Trout	163732	13	45	18148	16	18548	16	9.4	5.2	0.051	0.114
Round Goby	577	27	0	4476	26	29075	11	2.3	8.2	0.077	0.159
White Bass	4515	26	1	2426	11	10053	14	1.3	2.8	0.025	0.215
White Perch	4541	19	1	2252	29	6774	18	1.2	1.9	0.017	0.451
Walleye	34144	17	9	1995	8	2135	8	1.0	0.6	0.005	0.049
Largemouth Bass	3588	5	1	1189	3	2024	2	0.6	0.6	0.004	0.497
Freshwater Drum	2111	22	1	1146	55	44266	6	0.6	12.5	0.115	1.104
Smallmouth Bass	3143	28	1	733	15	1036	13	0.4	0.3	0.002	0.194
Rainbow Smelt	93	94	0	521	28	1367	19	0.3	0.4	0.005	0.286
White Crappie	1432	8	0	307	6	394	20	0.2	0.1	0.001	0.187
Coho Salmon	7439	9	2	199	27	211	26	0.1	0.1	0.001	0.042
Rock Bass	593	24	0	164	14	892	12	0.1	0.3	0.002	0.225
Pumpkinseed	1874	16	1	122	0	4600	14	0.1	1.3	0.009	0.813
Channel Catfish	1002	51	0	97	28	1047	45	0.1	0.3	0.003	0.277
Black Crappie	234	69	0	53	94	154	37	0.0	0.0	0	0.231
White Sucker	0		0	45	0	61	0	0.0	0.0	0	
Any Species	2926	21	1	38	0	363	75	0.0	0.1	0.001	0.029
Brown Trout	659	0	0	31	0	31	0	0.0	0.0	0	0.047
Bluegill	418	54	0	26	0	1596	15	0.0	0.4	0.004	1.484
Chinook Salmon	656	76	0	21	64	21	64	0.0	0.0	0	0.033
SALMONINAE	581	84	0	10	0	10	0	0.0	0.0	0	0.047
Common Carp	92	87	0	5	87	104	31	0.0	0.0	0	0.053
Longnose Gar	0		0	0		37	0	0.0	0.0	0	
Bowfin	0		0	0		18	94	0.0	0.0	0	
Northern Pike	249	50	0	0		194	81	0.0	0.1	0	0.067
Muskellunge	0		0	0		6	0	0.0	0.0	0	
Brown Bullhead	0		0	0		164	32	0.0	0.0	0.001	
Burbot	0		0	0		21	0	0.0	0.0	0	
Totals	404184		110	193753		354798		100.0	100.0		

NOTES:

Percent target is greater than 100% because some anglers targeted more than one species simultaneously.

Total estimated angling effort was 361,805 rod hours.

Observed CUEs (all) were calculated from observed catch/observed effort values from all anglers.

Observed CUEs (target) were calculated from targeted observed catch/ targeted observed effort values from anglers targeting specific species.

Table 3. Estimated angling effort, catch, harvest, and CUE for yellow perch for each access point from the Access Point Creel Survey, Central Basin, Lake Erie, June 7-August 31, 2004 (RSE= relative standard error).

Access Point (Port)	Targeted Effort (rd-hr)	% RSE	% Target	Est. Harvest (#)	% RSE	Est. Catch (#)	% RSE	% of Total Harvest	% of Total Catch	Obs. CUE (all)	Obs. CUE (target)
Port Burwell	31169	14	77	42900	16	66565	16	26.9	29.0	1.489	1.852
Port Bruce	74990	7	89	68945	8	102493	8	43.2	44.7	1.440	1.628
Port Stanley	4809	19	71	2392	33	4691	22	1.5	2.0	0.638	0.926
Port Glasgow	20993	9	53	11892	22	16900	17	7.4	7.4	0.618	1.645
Erieau	24766	13	16	22772	25	26013	24	14.3	11.3	0.121	0.853
Wheatley	12518	30	34	10806	47	12728	46	6.8	5.5	0.177	0.941
Totals	169245		340	159707		229390		100.0	100.0		

NOTES:

Percent target is greater than 100% because some anglers targeted more than one species simultaneously.

Observed CUEs (all) were calculated from observed catch/observed effort values from all anglers.

Observed CUEs (target) were calculated from targeted observed catch/targeted observed effort values from anglers targeting specific species.

Table 4. Estimated angling effort, catch, harvest, and CUE for rainbow trout for each access point from the Access Point Creel Survey, Central Basin, Lake Erie, June 7-August 31, 2004 (RSE= relative standard error).

Access Point (Port)	Targeted Effort (rd-hr)	% RSE	% Target	Est. Harvest (#)	% RSE	Est. Catch (#)	% RSE	% of Total Harvest	% of Total Catch	Obs. CUE (all)	Obs. CUE (target)
Port Burwell	5157	31	13	512	28	583	29	2.8	3.1	0.014	0.106
Port Bruce	2282	29	3	219	32	219	32	1.2	1.2	0.004	0.095
Port Stanley	0		-	-		-	-	-	-	-	-
Port Glasgow	18011	14	45	1231	20	1461	15	6.8	7.9	0.049	0.077
Erieau	115902	18	76	12025	15	12072	15	66.3	65.1	0.093	0.118
Wheatley	22380	30	61	4161	53	4214	53	22.9	22.7	0.107	0.137
Totals	163732		198	18148		18549		100.0	100.0		

NOTES:

Percent target is greater than 100% because some anglers targeted more than one species simultaneously.

Observed CUEs (all) were calculated from observed catch/observed effort values from all anglers.

Observed CUEs (target) were calculated from targeted observed catch/targeted observed effort values from anglers targeting specific species.

Table 5. Estimated angling effort, catch, harvest, and CUE for walleye for each access point from the Access Point Creel Survey, Central Basin, Lake Erie, June 7-August 31, 2004 (RSE= relative standard error).

Access Point (Port)	Targeted Effort (rd-hr)	% RSE	% Target	Est. Harvest (#)	% RSE	Est. Catch (#)	% RSE	% of Total Harvest	% of Total Catch	Obs. CUE (all)	Obs. CUE (target)
Port Burwell	2215	37	5	115	48	115	48	5.8	5.4	0.003	0.055
Port Bruce	1677	27	2	102	20	102	20	5.1	4.8	0.002	0.062
Port Stanley	0		0	0		0		0.0	0.0	0	0
Port Glasgow	2779	4	7	105	9	143	16	5.3	6.7	0.004	0.037
Erieau	23559	23	16	1477	9	1499	9	74.1	70.2	0.009	0.048
Wheatley	3899	48	11	195	35	275	27	9.8	12.9	0.009	0.050
Totals	34129		41	1994		2134		100.0	100.0		

NOTES:

Percent target is greater than 100% because some anglers targeted more than one species simultaneously.

Observed CUEs (all) were calculated from observed catch/observed effort values from all anglers.

Observed CUEs (target) were calculated from targeted observed catch/targeted observed effort values from anglers targeting specific species.

Table 6. Estimated angling effort, catch, harvest, and CUE for smallmouth bass for each access point from the Access Point Creel Survey, Central Basin, Lake Erie, June 7-August 31, 2004 (RSE= relative standard error).

Access Point (Port)	Targeted Effort (rd-hr)	% RSE	% Target	Est. Harvest (#)	% RSE	Est. Catch (#)	% RSE	% of Total Harvest	% of Total Catch	Obs. CUE (all)	Obs. CUE (target)
Port Burwell	0		0	0		61	46	0.0	6.2	0.001	
Port Bruce	393	94	0	18	95	110	38	2.5	11.2	0.002	0.067
Port Stanley	0		0	0		0		0.0	0.0	0	0
Port Glasgow	0		0	0		0		0.0	0.0	0	0
Erieau	2335	34	2	695	15	814	16	97.5	82.6	0.006	0.380
Wheatley	329	0	1	0		0		0.0	0.0	0	0
Totals	3057		3	713		985		100.0	100.0		

NOTES:

Percent target is greater than 100% because some anglers targeted more than one species simultaneously.

Observed CUEs (all) were calculated from observed catch/observed effort values from all anglers.

Observed CUEs (target) were calculated from targeted observed catch/targeted observed effort values from anglers targeting specific species.

Table 7. The distribution of angling methods used by angling parties in the central basin of Lake Erie from June 7 to August 31, 2004.

Angling Method	% of Parties
Still	66.2
Jig	0.2
Drift	11.5
Troll	3.3
Down Rig	18.4
Spin Cast	0.1
Fly Cast	0
Combination/Other	0.2

Table 8. The distribution of angler origin in the central basin of Lake Erie from June 7 to August 31, 2004.

Angler Origin	% of Parties
Local	62.1
Ontario	33.9
Canada	0.1
United States	3.9
Other	0

Table 9. The distribution of angler visitor status in the central basin of Lake Erie from June 7 to August 31, 2004.

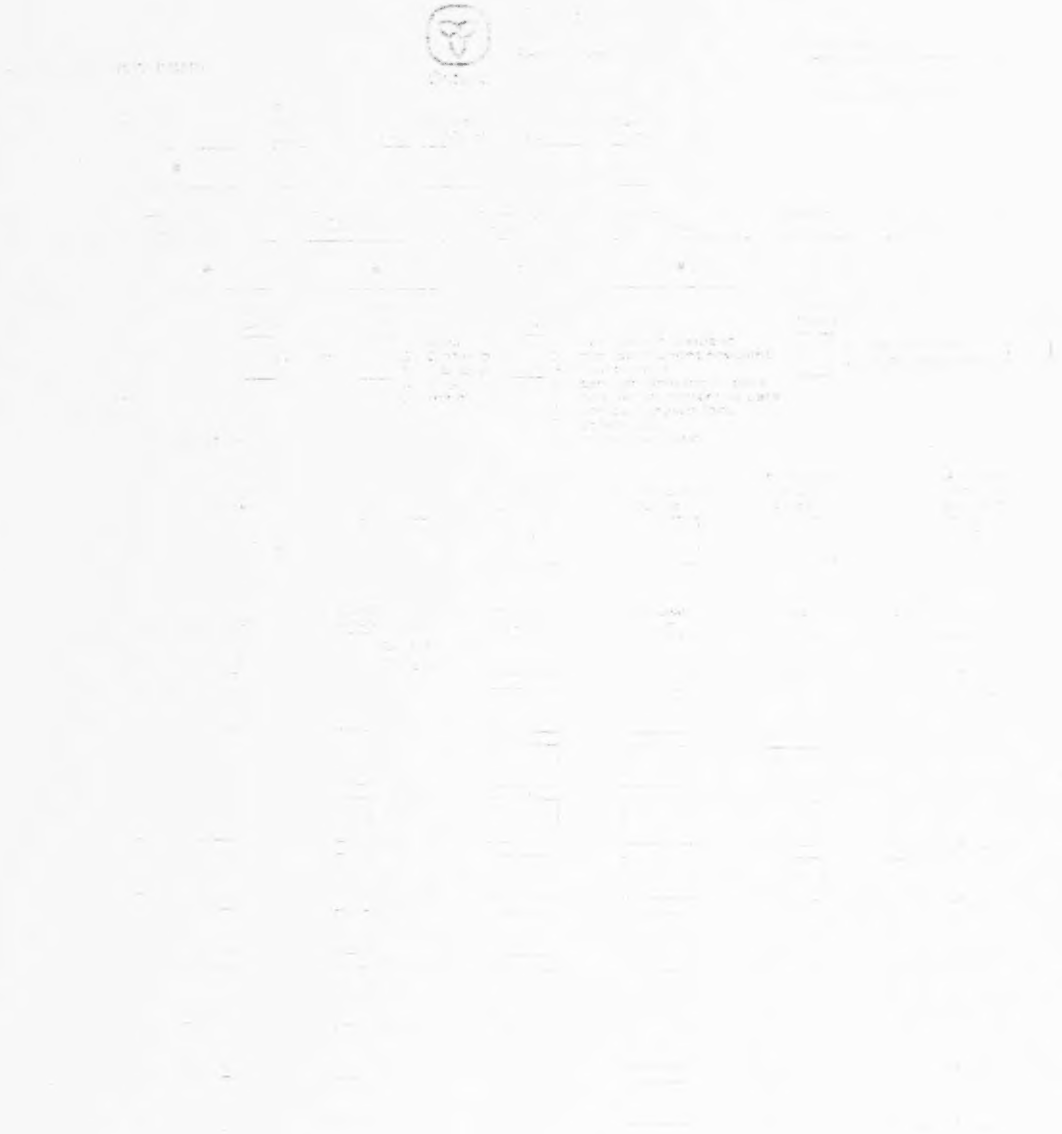
Angler Visitor Status	% of Parties
Permanent Resident	51.0
Non-permanent Resident	2.1
Day Tripper	43.2
Camper- Provincial Park	2.2
Camper- Commercial Park	0.4
Camper- Crown Land	0.1
Other- Paid	0.6
Other- Non-paid	0.4

Table 10. Estimates of total central basin effort and estimates of targeted effort, catch, harvest, and catch per unit effort for walleye, yellow perch, smallmouth bass, and rainbow trout from central basin aerial creel surveys (1990-1998) and an access point survey (2004).; with data from Sztramko (2000)

Year	Basin	Total Central Basin	**Walleye**				**Smallmouth Bass**				**Yellow Perch**				**Rainbow Trout**			
			Estimated effort (rod hours)	Estimated catch (number)	Estimated harvest (number)	CUE*	Estimated effort (rod hours)	Estimated catch (number)	Estimated harvest (number)	CUE*	Estimated effort (rod hours)	Estimated catch (number)	Estimated harvest (number)	CUE*	Estimated effort (rod hours)	Estimated catch (number)	Estimated harvest (number)	CUE*
1990	WC	31,776	28716	13549	13110	0.443	56	38	38	0.625	1312	712	591	0.246	1705	163	144	0.064
aerial creel	EC	80,268	71553	22388	21763	0.269	94	52	5	0.113	9123	3163	2379	0.294	394	24	24	0.047
	basin	**112,044**																
1991	WC	78,981	70356	23794	23681	0.301	979	147	92	0.05	2501	2638	1261	0.937	12526	567	495	0.031
aerial creel	EC	155,465	151407	44759	44054	0.252	340	598	548	0.857	171	1356	1179	0.16	35886	5672	5246	0.126
	basin	**234,446**																
1992	WC	84,909	80842	57005	56007	0.618	120	57	26	0.128	1234	2397	1708	1.642	3281	589	576	0.042
aerial creel	EC	151,064	145134	25477	24172	0.173	0	34	34		1647	2048	1622	1.1	9123	1372	1372	0.095
	basin	**235,973**																
1998	WC	90,879	50810	5004	4972	0.084	1495	183	145	0.201	0	5	0	0	67329	8172	7554	0.109
aerial creel	EC	75,364	55427	4743	4650	0.091	0	0	0	0	2713	996	587	0.37	37417	3497	3321	0.086
	basin	**166,243**																
2004	WC- boat	184,487	30115	1859	1741	0.046	2397	637	602	0.176	23026	37241	32199	1.761	155762	17651	17352	0.115
access creel	EC -boat	49,679	3776	207	207	0.056	0	0	0		41175	102952	68726	2.317	7221	714	786	0.105
	basin	**234,166**																
2004	WC- shore	44,286	122	36	59	0.308	267	177	93	0.405	35251	18399	13271	0.574	531	95	65	0.116
access creel	EC -shore	81,950	115	11	11	0.094	393	154	18	0.067	69792	70798	45512	1.302	218	17	17	0.071
	basin	126,236																
2004	WC- total	228,774	30237	1917	1777	0.047	2665	814	695	0.208	58276	55640	45470	1.224	156293	17746	17417	0.115
access creel	EC -total	131,626	3892	217	217	0.057	393	172	18	0.067	110967	173750	114238	1.724	7439	731	802	0.103
	basin	**360,402**	34144	2135	1995	0.049	3143	1036	733	0.194	169585	229596	159749	1.602	163732	18548	18148	0.114
2004	WC - diary		1951	73	19	0.037	0	0	0		441.87	2703	1874	6.117	2827	529	496	0.187
angler diary	EC - diary		632	12	12	0.019	12.83	4	3	0.312	830.62	2056	1444	2.475	698	83	73	0.119
	basin		2583	85	31	0.033	12.83	4	3	0.312	1272.48	4756	3318	3.74	3525	612	569	0.174

* CUE calculations derived from observed targeted catch in numbers / observed targeted effort in rod-hours

Appendix 1. An example of the OMNR Creel Log Form No. 948 (84/03)



Appendix 2. Expanded description of FISHNET calculations used to produce creel estimates (Lester and Korver, 1996).

Activity:

Initial estimate of fishing trips $\mathrm{TRIPNE}_{hij} = \mathrm{ATYCNT}_{hij}$

ATYCNT= activity count
h= stratum
i= sample day
j= line of log form

Total number of trips that occurred during the sampled STRATUM-PERIOD $\mathrm{TRIPNE}_{hi} = \text{Sum of } \mathrm{TRIPNE}_{hij}$

Effort:

Estimated party effort $\mathrm{EFFPE}_{hi} = \mathrm{TRIPNE}_{hi} * \text{Sum of } \mathrm{EFFDUR}_{hik} / \mathrm{CIF\_NN}_{hi}$

EFFDUR= duration of the fishing trip
CIF_NN= number of interviews
k= an interview

Estimated angler effort $\mathrm{EFFAE}_{hi} = \mathrm{TRIPNE}_{hi} * \text{Sum of } \mathrm{EFFAO}_{hik} / \mathrm{CIF\_NN}_{hi}$

EFFAO= $\mathrm{EFFDUR}_{hik} * \mathrm{ANGLERS}_{hik}$ (number of anglers)

Estimated rod effort $\mathrm{EFFRE}_{hi} = \mathrm{TRIPNE}_{hi} * \text{Sum of } \mathrm{EFFRO}_{hik} / \mathrm{CIF\_NN}_{hi}$

EFFRO= $\mathrm{EFFDUR}_{hik} * \mathrm{RODS}_{hik}$ (number of rods)

Catch and Harvest:

Daily estimates of #s caught $\mathrm{CATNE}_{hi} = \mathrm{TRIPNE}_{hi} * \text{Sum of } \mathrm{CATNO}_{hik} / \mathrm{CIF\_NN}_{hi}$

CATNO= number of fish (of a given species)

Daily estimates of #s harvested $\mathrm{HVSNE}_{hi} = \mathrm{TRIPNE}_{hi} * \text{Sum of } \mathrm{HVSNO}_{hik} / \mathrm{CIF\_NN}_{hi}$

HVSNO= number of fish harvested

Targeted Effort, Catch, and Harvest:

Targeted effort $EFFAE1_{hi} = TRIPNE_{hi} * \text{Sum of } EFFAO1_{hik} / CIF\_NN_{hi}$

EFFAO1= EFFAO if the species was sought and 0 otherwise

Targeted catch $CATNE1_{hi} = TRIPNE_{hi} * \text{Sum of } CATNO1_{hik} / CIF\_NN_{hi}$

CATNO1= CATNO if the party was seeking the species and 0 otherwise

Targeted harvest $HVSNE1_{hi} = TRIPNE_{hi} * \text{Sum of } HVSNO1_{hik} / CIF\_NN_{hi}$

HVSNO1= HVSNO if the party was seeking the species and 0 otherwise

Stratum Estimates:

Total effort per stratum $EFFAE_h = STRAT\_DAYS_h * meanEFFAE_h$

meanEFFAE= Sum of $EFFAE_{hi} / SAM\_DAYS_h$ (# of days sampled)
STRAT_DAYS= # of days in the stratum

Variance of this estimate $var(EFFAE_h)=FPC_h*STRAT\_DAYS_h^2*var(meanEFFAE_{hi})$

FPC= finite population correlation factor ($FPC_h = 1\text{-}SAM\_DAYS_h / STRAT\_DAYS_h$)

Variance of the daily mean $var(meanEFFAEh) = s^2 / SAM\_DAYS$

s^2= (Sum of ($EFFAE_{hi}$ – mean $EFFAE_h)^2$) / (SAM_DAYS_h – 1)

Relative standard error of an estimate is obtained by dividing the standard error of the estimate (SE(r)) by the estimate itself (r) and multiplying by one hundred.

RSE=100 x (SE(r)/r)

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